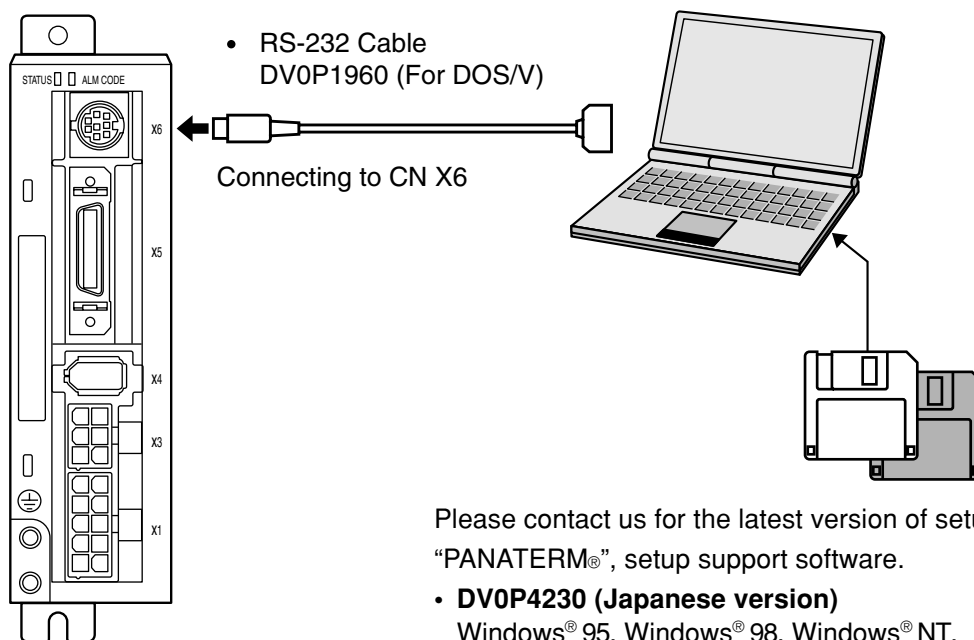


Reference

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Outline of “PANATERM®”, Setup Support Software

Connection Method



Please contact us for the latest version of setup disk of “PANATERM®”, setup support software.

- **DV0P4230 (Japanese version)**
Windows® 95, Windows® 98, Windows® NT,
Windows® 2000, Windows® Me, Windows® XP
(Each Japanese version)
- **DV0P4240 (English version)**
Windows® 95, Windows® 98, Windows® NT,
Windows® 2000, Windows® Me, Windows® XP
(Each English version)

Installing PANATERM® on Hard Disk

<Cautions/Remarks>

1. The capacity of hard disk memory should be 15 MB or more. As OS, prepare Windows® 95, Windows® 98, Windows® NT, Windows® 2000, Windows® Me and Windows® XP (each of them should be a Japanese version).
2. You can start “PANATERM®” only after installing it on the hard disk with the setup disk, by following the steps described below.

Steps of Procedure

- (1) Power on your personal computer and start a corresponding OS (If there is any running application program, terminate it).
- (2) Insert PANATERM® Setup disk 1 into the floppy disk drive.
- (3) Start Explorer and select the floppy disk drive.
(For starting of Explorer, see the manual of the corresponding OS.)
- (4) Double click on the setup program (Setup.exe) on the floppy disk (Then, PANATERM® setup program will start.).
- (5) To start the setup program, press .
- (6) Operate by following the guidance of the setup program.
(Follow the instruction to change the setup disc 1 to disc 2 during the course.)
- (7) Click on button, and setup will start.
- (8) Click when the message “Setup completed” appears.
- (9) Close all application programs and then restart Windows®. When it restarts, PANATERM® will be added to the program menu.

Starting PANATERM®

<Cautions/Remarks>

1. Once you have installed “PANATERM®” on the hard disk, you do not have to reinstall it every time you boot up.
2. Before you start, connect the driver with the power supply, motor, and encoder. For the startup procedure, refer to the manual of the corresponding OS.

Steps of Procedure

- (1) Power on your personal computer and start the corresponding OS.
- (2) Turn on the driver.
- (3) Click on Start button of the corresponding OS of the personal computer.
(For the startup procedure, refer to the manual of the corresponding OS.)
- (4) Select PANATERM® in the program ►.
- (5) After opening splash is displayed for 2 seconds, PANATERM® screen will appear.

For any detailed information on operation/functions of “PANATERM®”, refer to the operating instructions of “PANATERM®”.

* Windows®, Windows® 95, Windows® 98, Windows® NT, Windows® 2000, Windows® Me, Windows® XP are the trademarks of Microsoft Corporation in the United States.

Communications

Outline of Communications

With a personal computer or host NC connected with MINAS-E Series through RS232C-compliant serial communications, you can do the following:

- (1) Rewriting parameters**
- (2) Browsing and clearing status and history of alarm data**
- (3) Monitoring control status including status, I/O, etc.**
- (4) Saving and Loading parameters**

Advantages

- You can write parameters all at once from the host when starting the machine.
- As you can display operating condition of the machine, serviceability will improve.

Note that the following application programs for a personal computer and cables are available for use. For information of PANATERM®, refer to the instruction manual of PANATERM®.

Name of Optional Components	Model Name
PANATERM® Japanese version (WIN95/98/Me/NT4.0/2000/XP)	DV0P4230
PANATERM® English version (WIN95/98/Me/NT4.0/2000/XP)	DV0P4240
Connection cable for personal computer (DOS/V)	DV0P1960

For the latest version, please contact us.

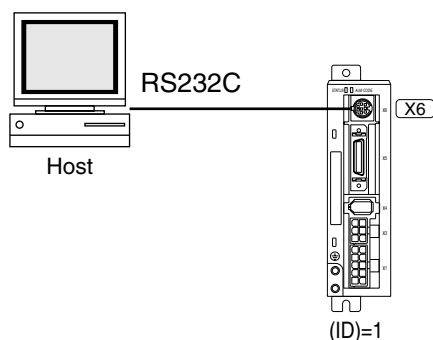
Communications Specification

Connection of Communications Line

MINAS-E Series has RS232C communications port. and is capable of communications between the host as follows:

■ RS232C Communications

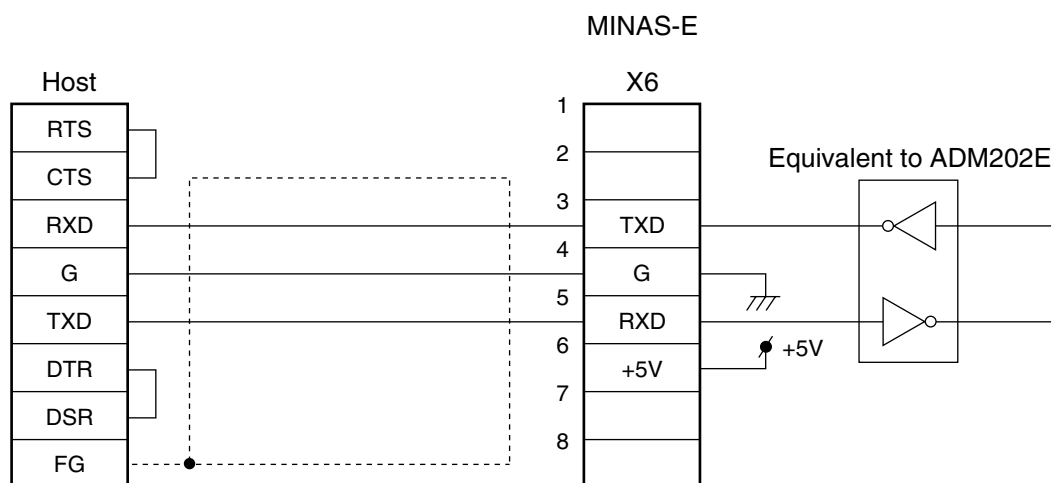
In RS232C communications, a host and the driver are connected 1:1 and communicate with each other according to the RS232C transmission protocol.



You can change settings of the module ID with Pr00. In particular, you may set the same module ID unless
 ● there is management problem on the host side.

Interface of Communication Connector Unit

■ Connection with a Host through RS232C



<Note>

You must leave pins 1, 2, 6, 7 and 8 of X6 unconnected.

Communications

Communications Method

	RS232C
	Full-duplex, asynchronous communication method
Communications baud rate	2400, 4800, 9600bps
Data	8 bit
Parity	No
Start bit	1 bit
Stop bit	1 bit

- Set RS232C communications baud rate with Pr0C. Any change to these parameters will be valid when you power on the control power supply. For detailed information, refer to list of parameters related to the following communications:

List of User Parameters Related to Communications

PrNo.	Parameter Name	Range of Setting	Functional Description
00	Shaft name	1 - 15	Refer to descriptions on parameters on pages 88 and 116.
0C	Setting of baud rate for RS232C communications	0 - 2	Set the communications speed of RS232C communications. 0 : 2400[bps] 1 : 4800[bps] 2 : 9600[bps] A change will be valid when you power on the control power supply.

- Time for data transmission is calculated with the following expression, for instance, in the case of 9600 [bps]:

$$(1000/9600) \times (1 + 8 + 1) = 1.04 \text{ [ms/byte]}$$



When the baud rates of 2400 bps and 4800 [bps] are used, data transmission time will be 4.17 [ms/byte] and 2.08 [ms/byte], respectively. Note, however, actual communication time will be added time necessary for processing received command, and necessary for switching between a line and transmission/reception control.

Handshaking Code

For line control, the following codes are used.

Name	Code	Functions
ENQ	05h	Transmission request
EOT	04h	Ready for receiving
ACK	06h	Acknowledgement
NAK	15h	Negative acknowledgement

ENQ ... When the module has a block to transmit, it sends ENQ.

EOT ... When the module is ready to receive a block, it sends EOT. The line enters transmission mode when sending ENQ and receiving EOT. It enters reception mode when receiving ENQ and sending EOT.

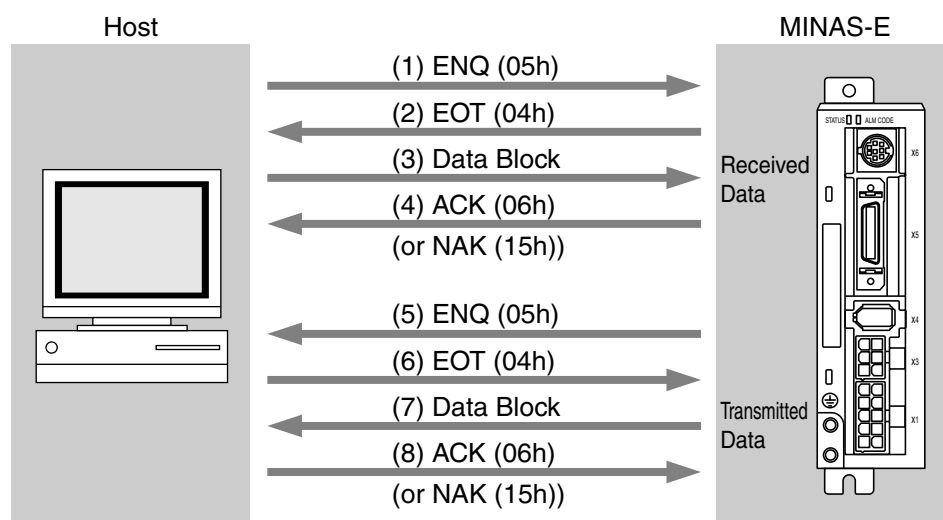
ACK ... When a received block is judged normal, ACK is returned.

NAK ... When a received block is judged as abnormal, NAK is returned. A judgment is made based on checksum and timeout.

Transmission Sequence

■ Transmission Protocol

● RS232C



● Line Control

Direction of transmission and conflict are solved.

Reception mode ... The module enters reception mode after receiving ENQ and returning EOT.

Transmission mode ... The module enters transmission mode after sending ENQ and receiving EOT.

When there occurs a conflict between the transmitting module and receiving module:

When subsequent to transmission of ENQ, a slave receives ENQ while waiting for EOT, priority is given to ENQ sent from a master, and the slave enters the reception mode.

● Transmission Control

Entering transmission mode, a module transmits a command block continuously and then waits for reception of ACK. When the module receives ACK, transmission is complete. When the number of transferred command bytes is incorrect, ACK may not be returned. When ACK is not returned within T2 period, or when NAK or any code other than ACK is received, transmission retry will be executed. The retry will start with ENQ.

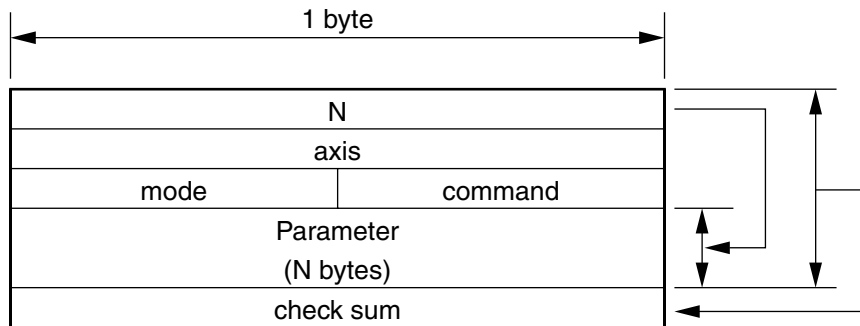
● Receiving Control

Entering receiving mode, the module receives transmitted blocks continuously. It obtains the number of command bytes from the first byte, and receives as many command bytes as that number plus 3. When the sum of received data is zero, reception is considered successfully ended and ACK is returned. When abnormal checksum or timeout between characters occurs, NAK is sent.

Communications

■ Configuration of Data Block

A data block to be transmitted in physical phase is configured as illustrated below:



- N** : This is the number of command bytes (0 - 240), which indicates the number of parameters needed by a command.
- axis** : This defines a module ID assigned to parameter No.00 axis name of the driver. (1 - 15)
- command** : This is the control command (0 - 15).
- mode** : This is the command execution mode (0 - 15), which differs depending on a command.
- check sum** : This is 2's complement of the total number of bytes, ranging from the first byte to the byte immediately before the checksum byte.

■ Protocol Parameter

The following parameters can control transfer of a block. A user can set these parameters to any value with INIT command to be described later.

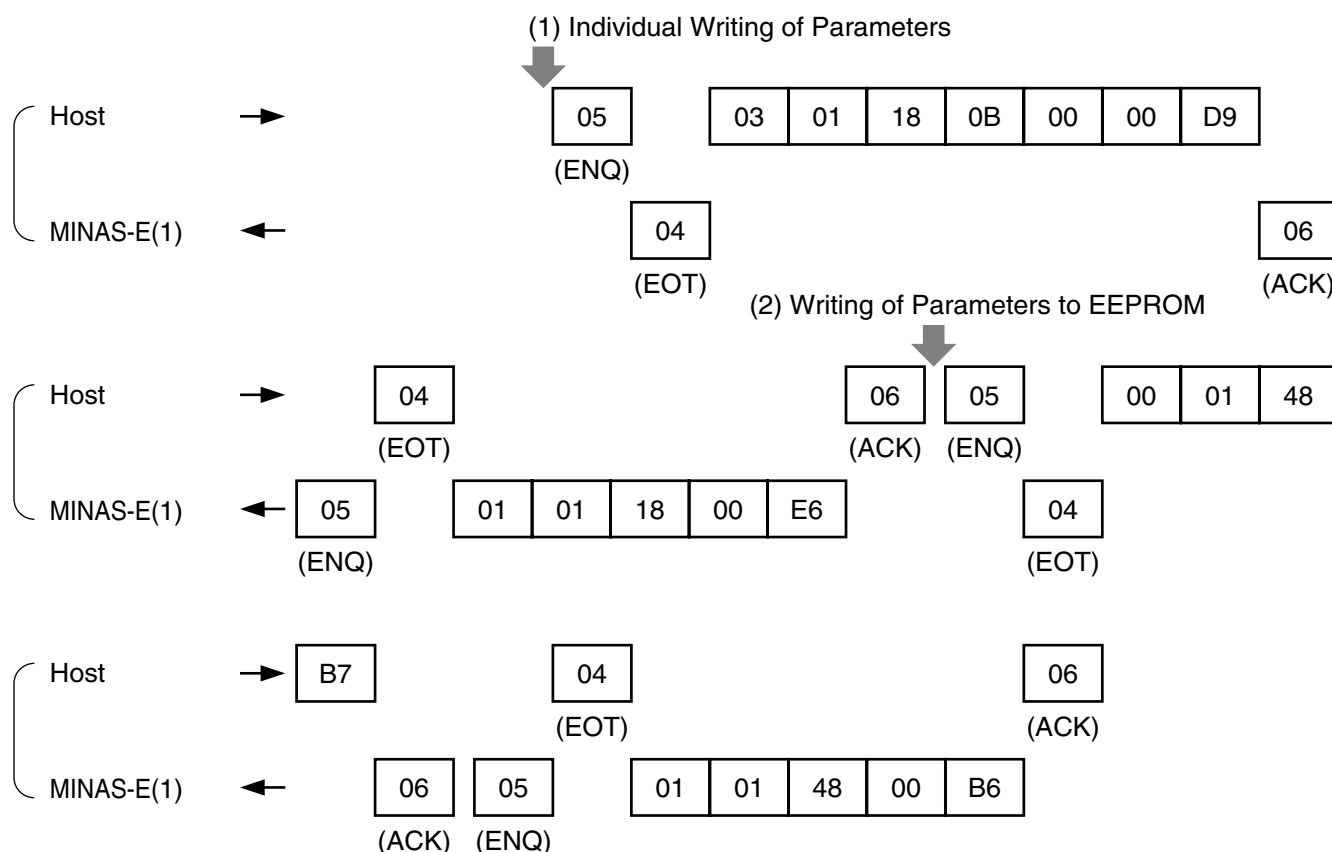
Name	Function	Initial Value	Range of Settings	Unit
T1	Timeout between character transmissions	5 (0.5 second)	1 - 255	0.1 second
T2	Protocol time limit	10 (10 seconds)	1 - 255	1 second
RTY	Retry limit	1 (once)	1 - 8	once
M/S	Master/slave	0 (slave)	0, 1(master)	

- T1** • This is allowable time between module identification byte and ENQ/EOT, or time from reception of a character code by this device to that of a next character code in a transmission/reception data block. When this specified time is exceeded, timeout error occurs and NAK is returned to the transmitting module.
- T2** • This is allowable time after this device transmits ENQ till it receives EOT. When this specified time is exceeded, it means that the receiving module is not ready to receive data or fails to receive ENQ code for some reason. In this case, ENQ code will be resent to the receiving module (number of retries).
- This is allowable time after EOT is sent out till a first character is received. When this specified time is exceeded, NAK is returned and the receiving mode ends.
 - This is allowable time after checksum byte is sent out till ACK is received. When this specified time is exceeded, ENQ code is resent to the receiving module, as in the case of reception of NAK.
- RTY** This shows the maximum number of retries. When this specified value is exceeded, transmission error occurs.
- M/S** This shows switching of a master/slave. When conflict of ENQ transmission occurs, this parameter determines to which priority is given. (0=slave mode, 1=master mode) Transmission of the module defined as a master should take precedence.

Example of Data Communication

■ Example of Changing Parameters

The following illustrates time-series communications data flow when a change is made to a parameter. Communications should be conducted in the sequence of outline, (1) individual writing of parameters and (2) writing to EEPROM if storage is needed. In this example of hardware connection, the device is directly connected with a host through RS232C communications with user ID=1. Data is represented in hexadecimals.

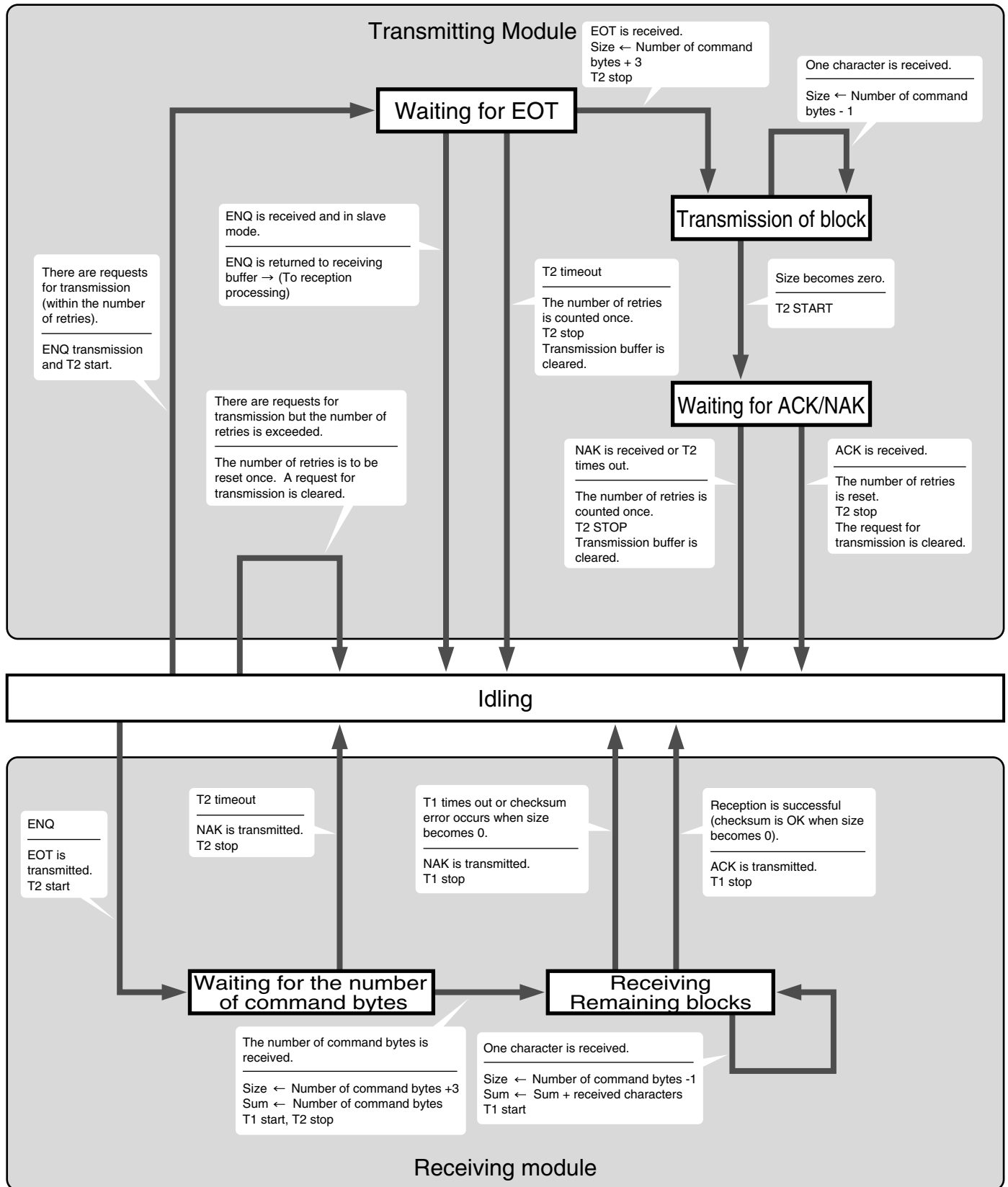


(Note) For details of commands, refer to “List of Communications Commands” on Page 166.

Communications

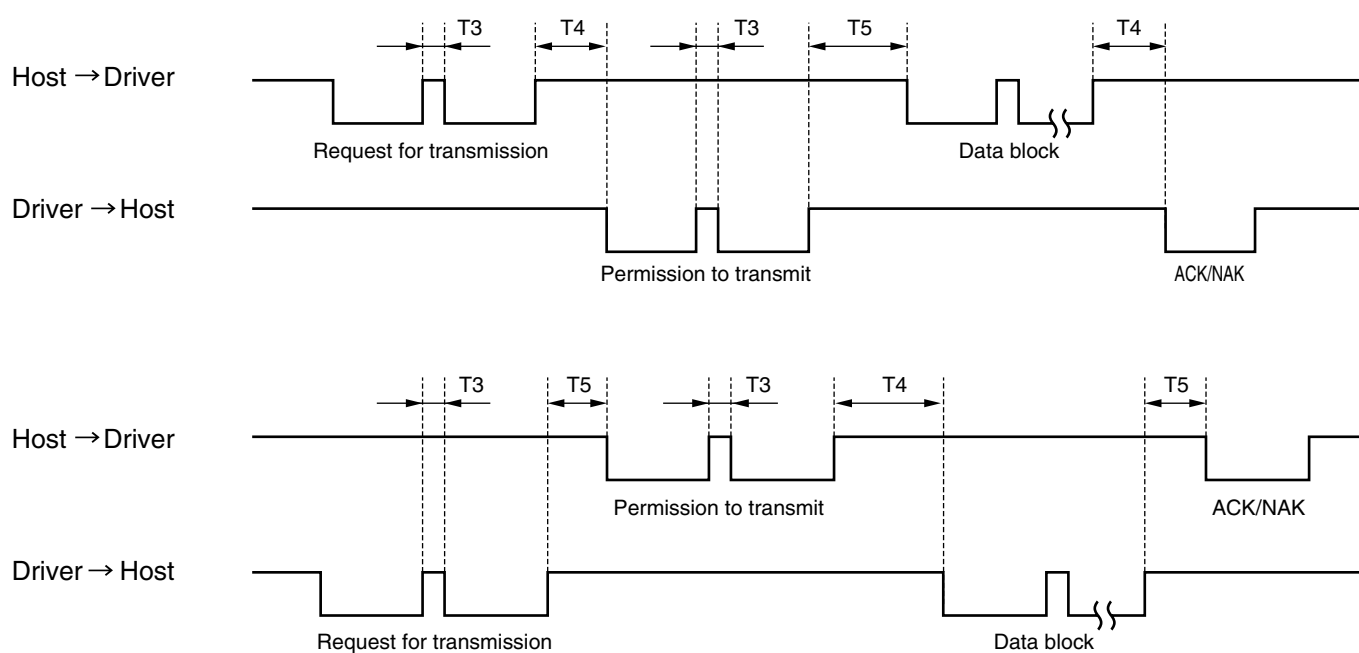
State Transition Diagram

■ RS232C Communications



Communications Timing

■ RS232C Communications



Code	Name	Minimum	Maximum
T3	Continuous inter-character time	Stop bit length	Protocol parameter T1
T4	Driver response time	4ms	Protocol parameter T2
T5	Host response time	2ms	Protocol parameter T2

<Caution>

The time represents a period of time from stop bit rising edge.

Communications

List of Communications Commands

command	mode	Description
0		NOP
	1	Readout of CPU version
	5	Readout of the driver model name
	6	Readout of the motor model name
1		INIT
	1	Setting of protocol parameters
2		POS, STATUS, I/O
	0	Readout of status
	1	Readout of the command pulse counter
	2	Readout of the feedback pulse counter
	4	Readout of current speed
	5	Readout of current torque output
	6	Readout of the current deviation counter
	7	Readout of input signal
	8	Readout of output signal
	9	Readout of current speed/torque/deviation counter
	A	Readout of status/input signal/output signal
8		PARAMETER
	0	Individual readout of parameters
	1	Individual writing of parameters
	4	Writing of parameters to EEPROM
9		ALARM
	0	Readout of current alarm data
	1	Individual readout of alarm history
	2	Batch readout of alarm history
	3	Alarm history clear (also on EEPROM)
	4	Alarm clear
B		PARAMETER
	0	Individual readout of user parameters
	1	Page readout of user parameters
	2	Page writing of user parameters

<Note>

Be sure to use the above commands only. We could not guarantee proper operation of the driver when you transmit a command not listed above.

Details on Communications Commands

command	mode
0	1

● Readout of CPU version information

Received data

0	
axis	
1	0
checksum	

Transmitted data

3	
axis	
1	0
Version (high order)	
(low order)	
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error					
1 : Error							

- For version information, Ver.○.○.○ is divided into high order data and low order data and sent back. (The decimal point returns low-order 4 bits of the high order data as "0".)
- A version is expressed by digits of 0 to 9 (Example: Ver.3.13 is composed of high order data 30h and low order data 13h).
- This indicates the CPU version.

command	mode
0	5

● Readout of the driver model name

Received data	
0	
axis	
5	0
checksum	

Transmitted data	
0Dh	
axis	
5	0
Driver Model Name (high order)	
Driver Model Name (low order)	
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error					
1 : Error							

■ The driver model name is 12 characters and transmitted by ASCII code.
ex. "MKDET1505 * * *"

command	mode
0	6

● Readout of the motor model name

Received data	
0	
axis	
6	0
checksum	

Transmitted data	
0Dh	
axis	
6	0
Motor Model Name (high order)	
Motor Model Name (low order)	
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error					
1 : Error							

■ The motor model name is 12 characters and transmitted by ASCII code.
ex. "MUMA012P1 * * *"

command	mode
1	1

● Setting of RS232C protocol parameters

Received data	
3	
axis	
1	1
T1	
T2	
M/S	RTY
checksum	

Transmitted data	
1	
axis	
1	1
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error		RTY error	T2 error	T1 error	M/S error
1 : Error							

■ Setting of the previous protocol parameters remains valid until execution of this command completes. The updated parameter setting will be valid from a next command after execution of this command.
M/S=0 indicates "SLAVE" mode, while M/S=1 indicates "MASTER".
■ The RTY code is 4 bit and M/S is 1 bit.
■ Unit of T1 and T2 are 0.1 second and 1 second, respectively.

Communications

command	mode
2	0

● Readout of status

Received data	
0	
axis	
0	2
checksum	

Transmitted data	
3	
axis	
0	2
Control mode	
Status	
Error code	
checksum	

Status

bit7	6	5	4	3	2	1	0
		CCW Torque being output	CW Torque being output	CCW rotating	CW rotating	Less than DB permission speed	Torque being limited

Error code

bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error		Command error					

■ The control modes are defined as follows:

0	High speed response positioning control mode
1	Internal velocity control mode
2	High function positioning control

command	mode
2	1

● Readout of the command pulse counter

Received data	
0	
axis	
1	2
checksum	

Transmitted data	
5	
axis	
1	2
Counter value L	

H	
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error		Command error					

- A current command position is expressed by absolute coordinates from the start-up time. (Cumulative sum of the number of command pulses)
- The counter value is 32 bits.
- For the counter value, "-" indicates CW and "+" indicates CCW.

command	mode
2	2

● Readout of the feedback pulse counter

Received data	
0	
axis	
2	2
checksum	

Transmitted data	
5	
axis	
2	2
Counter value L	

H	
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error					
1 : Error							

- A current position of the feedback pulse counter is expressed by absolute coordinates from the start-up time.
- For the counter value, "-" indicates CW and "+" indicates CCW.
- The feedback pulse counter indicates a cumulative sum of pulses of the position detector, which corresponds to a position of the motor that really moves.

command	mode
2	4

● Readout of current speed

Received data	
0	
axis	
4	2
checksum	

Transmitted data	
3	
axis	
4	2
Data (current speed) L	

H	
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error					
1 : Error							

- This command is used to read current speed (unit [r/min]).
- An output value is 16 bits.
- For the counter value, "-" indicates CW and "+" indicates CCW.

command	mode
2	5

● Readout of current torque output

Received data	
0	
axis	
5	2
checksum	

Transmitted data	
3	
axis	
5	2
Data (torque) L	

H	
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error					
1 : Error							

- This command is used to read current torque output (unit: to be converted as rated torque = 2000).
- An output value is 16 bits.

Communications

command	mode
2	6

● Readout of the current deviation counter

Received data	
0	
axis	
6	2
checksum	

Transmitted data	
5	
axis	
6	2
Data (deviation) L	

H	
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error					
1 : Error							

- This command is used to read a current value of the deviation counter. (unit [pulse])
- An output value is 32 bits.
- "+" indicates that the encoder is in CW direction and "-" indicates that the encoder is in CCW direction relative to the position command.

command	mode
2	7

● Readout of input signal

Received data	
0	
axis	
7	2
checksum	

Transmitted data	
5	
axis	
7	2
Data L	

Data H	
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error					
1 : Error							

Data

bit7	6	5	4	3	2	1	0
Reserved	Command dividing/ multiplier switching	Zero speed clamp	Control mode switching	CCW overtravel inhibited	CCW overtravel inhibited	Alarm cleared	Servo-ON

bit15	14	13	12	11	10	9	8
Reserved	Reserved	Internal velocity command selection 2	Internal velocity command selection 1	Reserved	Counter cleared	Gain switching	Reserved

bit23	22	21	20	19	18	17	16
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

bit31	31	29	28	27	26	25	24
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

- For "CW overtravel inhibited", "CCW overtravel inhibited" and speed zero clamp, "1" indicates the open status. For other input signals, "0" indicates the open status.

command	mode
2	8

● Readout of output signal

Received data

0
axis
8 2
checksum

Transmitted data

7
axis
8 2
Data L

Data H

Warning data L
H
Error code
checksum

Warning data

bit7 Overload
bit5 Over-regeneration
bit0 Battery

Error code

bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error		Command error					

Data

bit7	6	5	4	3	2	1	0
Reserved	Reserved	Torque being limited	Zero speed detected	Electromagnetic brake released	Positioning completed	Servo alarm	Servo ready

bit15	14	13	12	11	10	9	8
Reserved	Reserved	Dynamic brake activated	Reserved	Reserved	Reserved	Speed achieved	Reserved

bit23	22	21	20	19	18	17	16
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

bit31	31	29	28	27	26	25	24
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

■ The following table shows the relation between each signal and operation.

Signal	0	1
Servo ready	not Ready	Servo ready
Servo alarm	Normal condition	Abnormal condition
In positioning completed	Positioning not completed	Positioning being completed
Electromagnetic brake released	Electromagnetic brake running	Electromagnetic brake released
Zero speed detected	Zero speed not detected	Zero speed detected
Torque being limited	Torque not being limited	Torque being limited
Achieved speed	Not achieved speed	Speed being achieved
Dynamic brake activated	Dynamic brake released	Dynamic brake being activated

command	mode
2	9

● Readout of current speed/torque/deviation counter

Received data

0
axis
9 2
checksum

Transmitted data

9
axis
9 2
Data L
(Speed) H
Data L
(Torque) H
Data L

(Deviation) H
Error code
checksum

Error code

bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error		Command error					

- The speed and torque output values are 16 bits and deviation output value is 32 bits.
- The unit and sign of output data are same for command Nos. 24, 25, and 26.

Communications

command	mode
2	A

● Readout of status/input signal/output signal

Received data

0	
axis	
A	2
checksum	

Transmitted data

0Dh	
axis	
A	2
Control mode	
Status	
Input signal L	

Input signal H	
Output signal L	

Output signal H	
Warning data L	
Warning data H	
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error					
1 : Error							

■ Meanings of each bit for control mode, status, input signal, output signal, and warning data are same as those of command No.20 (command=2, mode=0), 27 (mode=7), and 28 (mode=8).

bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error		Command error		No. error			

bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error	Data error	Command error		No. error			

■ Be sure to set 0 to unused parameters. Otherwise, data error will occur.

bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error	Data error	Command error				Control LV	

- When control power supply LV is detected, control LV of error code will be returned, and parameter writing will be disabled.

Communications

command	mode
9	0

● Readout of current alarm data

Received data	
0	
axis	
0	9
checksum	

Transmitted data	
2	
axis	
0	9
Alarm No.	
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error					
1 : Error							

- Alarm No. is 0 when no alarm is generated.
(Refer to "Details of Protective Function" on Page 145.)

command	mode
9	1

● Individual readout of alarm history

Received data	
1	
axis	
1	9
History No.	
checksum	

Transmitted data	
3	
axis	
1	9
History No.	
Alarm No.	
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error		No. error			
1 : Error							

- History No.1 to No.14 indicate the 1st to 14th previous alarm history, respectively.

command	mode
9	2

● Batch readout of alarm history

Received data	
0	
axis	
2	9
checksum	

1st previous
2nd previous
14th previous

Transmitted data	
0Fh	
axis	
2	9
Alarm No.	
Alarm No.	
~	
Alarm No.	
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error					
1 : Error							

- The command is used to read 14 previous alarm events.

command	mode
9	3

● Alarm history clear

0	
axis	
3	9
checksum	

1	
axis	
3	9
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal	Data error	Command error				Control LV	
1 : Error							

■ The command clears history of alarm data.
When the command fails to clear, data error occurs.

■ When control power supply LV is detected, control LV of error code will be returned, and parameter writing will be disabled.

command	mode
9	4

● Alarm clear

0	
axis	
4	9
checksum	

1	
axis	
4	9
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error					
1 : Error							

■ This command clears the current alarm (only applicable to alarms that can be cleared).

Communications

command	mode
B	0

● Individual readout of user parameters

Received data	
1	
axis	
0	B
Parameter No.	
checksum	

Transmitted data	
9	
axis	
0	B
Parameter value L	
H	
MIN value L	
H	
MAX value L	
H	
Attribute L	
H	
Error code	
checksum	

Attribute

bit7	6	5	4	3	2	1	0
Unused parameter	Display inhibited	For privileged users	To be changed at initialization	System related			

bit15	14	13	12	11	10	9	8
							Read only

Error code

bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error		Command error		No. error			

command	mode
B	1

● Page readout of user parameters

Received data	
1	
axis	
1	B
Page No.	
checksum	

Transmitted data	
82h	
axis	
1	B
Page No.	
Parameter value L	
(No.0) H	
MIN value L	
(No.0) H	
MAX value L	
(No.0) H	
Attribute L	
(No.0) H	
Parameter value L	
(No.0fh) H	
MIN value L	
(No.0fh) H	
MAX value L	
(No.0fh) H	
Attribute L	
(No.0fh) H	
Error code	
checksum	

Attribute

bit7	6	5	4	3	2	1	0
Unused parameter	Display inhibited	For privileged users	To be changed at initialization	System related			

bit15	14	13	12	11	10	9	8
							Read only

Error code

bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error	Data error	Command error		No. error			

■ A page number is designated from 0 to 7, and 16 parameters are read from each page designation.

command	mode
B	2

● Page writing of user parameters

Received data

Reserved data	
21h	
axis	
2	B
Page No.	
Parameter L	
(No.0 value) H	
Parameter value L	
(No.1 value) H	
~	
Parameter value L	
(No.0fh value) H	
checksum	

Transmitted data

2	
axis	
2	B
Page No.	
Error code	
checksum	

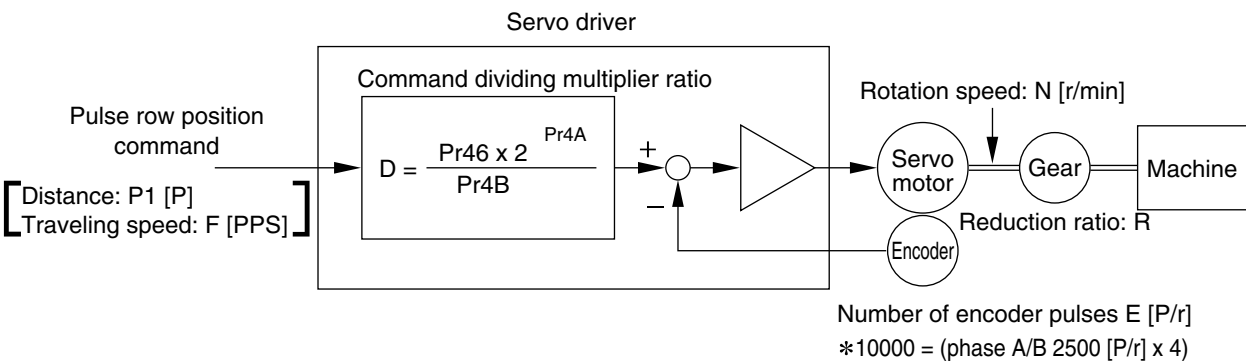
Error code

bit7	6	5	4	3	2	1	0
0 : Normal	Data error	Command error		No. error			
1 : Error							

- The command writes 16 parameters at once.
- Be sure to set 0 to unused parameters. Otherwise, data error will occur.

Description on Dividing/Multiplier Ratio

Relation between Positional Resolution/Moving Speed and Command Dividing Multiplier Ratio



As an example of a machine, we describe a ball screw driving system below:
When lead of a ball screw is L [mm], actual distance of a ball screw M [mm] with respect to the distance command P1 [P] is expressed with formula (1) below:

M = P1 x (D/E) x (1/R) x L (1)

Therefore, position resolution (distance DM per command pulse) is expressed by the following formula (2):

ΔM = (D/E) x (1/R) x L (2)

Through transformation of formula (2), a command dividing multiplier ratio D is determined by the formula (3):

D = (ΔM x E x R)/L (3)

In addition, actual traveling speed V [mm/s] of a ball screw with respect to traveling speed command F [PPS] is expressed by formula (4), and the corresponding motor rotation speed N is determined by formula (5):

V = F x (D/E) x (1/R) x L (4)

N = F x (D/E) x 60 (5)

Through transformation of formula (5), a command dividing multiplier ratio D is determined by the formula (6):

D = (N x E)/(F x 60) (6)

<Remarks>

- 1. Set the positional resolution (ΔM) at approx. 1/5 to 1/10 of the positioning accuracy (Δε), in view of mechanical errors.
- 2. Set a value from 1 to 10000 to Pr46 and Pr4B.
- 3. You can set any value depending on numerator and denominator settings. However, if you specify an extreme dividing/multiplier ratio, we cannot guarantee proper operation of the motor. We recommend that you set the dividing/multiplier ratio in the range of 1/50 to 20 times.

4.

2 ⁿ	Decimal
2 ⁰	1
2 ¹	2
2 ²	4
2 ³	8
2 ⁴	16
2 ⁵	32
2 ⁶	64
2 ⁷	128
2 ⁸	256
2 ⁹	512
2 ¹⁰	1024
2 ¹¹	2048
2 ¹²	4096
2 ¹³	8192
2 ¹⁴	16384
2 ¹⁵	32768
2 ¹⁶	65536
2 ¹⁷	131072

Example		Command dividing multiplier ratio $D = \frac{\Delta M \times E \times R}{L}$... Formula (3)	$D = \frac{\boxed{\text{Pr46}} \times 2^{\boxed{\text{Pr4A}}}}{\boxed{\text{Pr4B}}}$
1	Lead of ball screw L = 10mm Reduction ratio R=1 Position resolution $\Delta M = 0.005\text{mm}$ For the encoder of 2500 P/r (E=10000P/r)	$D = \frac{0.005 \times 10000 \times 1}{10}$ = 5	Determine parameters Pr46, Pr4A and Pr4B so that D=5. Consider the following: $D = \frac{10000 \times 2^0}{2000}$ Pr46 = 10000 Pr4A = 0 Pr4B = 2000
2	Lead of ball screw L = 20mm Reduction ratio R=1 Position resolution $\Delta M = 0.005\text{mm}$ For the encoder of 2500 P/r (E=10000P/r)	$D = \frac{0.0005 \times 10000 \times 1}{20}$ = 0.25	D<1 is not appropriate to determination of the accuracy. D = 1 is a condition of minimum resolution.

Example	Motor rotation speed (r/min) $N = F \times \frac{D}{E} \times 60$... Formula (5)
Lead of ball screw L= 20mm Reduction ratio R=1 Position resolution $\Delta M = 0.005\text{mm}$ Line driver pulse input 500 kpps For the encoder of 2500 P/r	$D = \frac{0.005 \times 10000 \times 1}{20}$... Formula (3) = 25 $N = 500000 \times \frac{2.5}{10000} \times 60$... Formula (5) = 7500 Thus, motor specification is not met.
To make motor rotation speed 3000 r/min under the same condition as above, with lead of ball screw of L = 20 mm and the line driver pulse input of 500 kpps.	Command dividing multiplier ratio $D = \frac{N \times E}{F \times 60}$... Formula (6)
	$D = \frac{3000 \times 10000}{500000 \times 60} = 1$ Determine parameters Pr46, Pr4A and Pr4B so that D=1. Consider the following: $D = \frac{10000 \times 2^0}{10000}$ Pr46 = 10000 Pr4A = 0 Pr4B = 10000
	Then, distance per command pulse (mm) is as follows: (position resolution) $\Delta M = \frac{D}{E} \times \frac{1}{R} \times L = \frac{1}{10000} \times \frac{1}{1} \times 20 = 0.002\text{mm}$

Conformance to EC Directives/UL Standards

EC Directives

The EC Directives apply to all such electronic products as those having specific functions and directly sold to general consumers in EU countries. These products are required to meet the EU unified standards and to be furnished with CE Marking.

However, our AC servo meet the EC Directives for Low Voltage Equipment so that the machine or equipment comprising our AC servo can meet relevant EC Directives.

EMC Directives

Our servo systems can meet EMC Directives and related standards. However, to meet these requirements, the systems must be limited with respect to configuration and other aspects, e.g. the distance between the servo driver and motor is restricted, and some special wiring conditions must be met. This means that in some cases machines and equipment comprising our servo systems may not satisfy the requirements for wiring and grounding conditions specified by the EMC Directives. Therefore, conformance to the EMC Directives (especially the requirements for emission noise and noise terminal voltage) should be examined based on the final products that include our servo drivers and servo motors.

Applicable Standards

Subject	Applicable standard		
Motor	IEC60034-1	Standards referenced by Low-Voltage Directives	
Motor and driver	EN50178		
	EN55011	Radio Disturbance Characteristics of Industrial, Scientific and Medical (ISM) Radio Frequency Equipment	Standards referenced by EMC Directives
	EN61000-6-2 General standards for immunity in industrial environment		
	IEC61000-4-2	Electrostatic Discharge Immunity Test	
	IEC61000-4-3	Radio Frequency Electromagnetic Field Immunity Test	
IEC61000-4-4	Electric High-Speed Transition Phenomenon - Burst Immunity Test		
	IEC61000-4-5	Lightning Surge Immunity Test	
	IEC61000-4-6	High Frequency Conduction Immunity Test	
	IEC61000-4-11	Instantaneous Outage - Immunity Test	

IEC: International Electrotechnical Commission

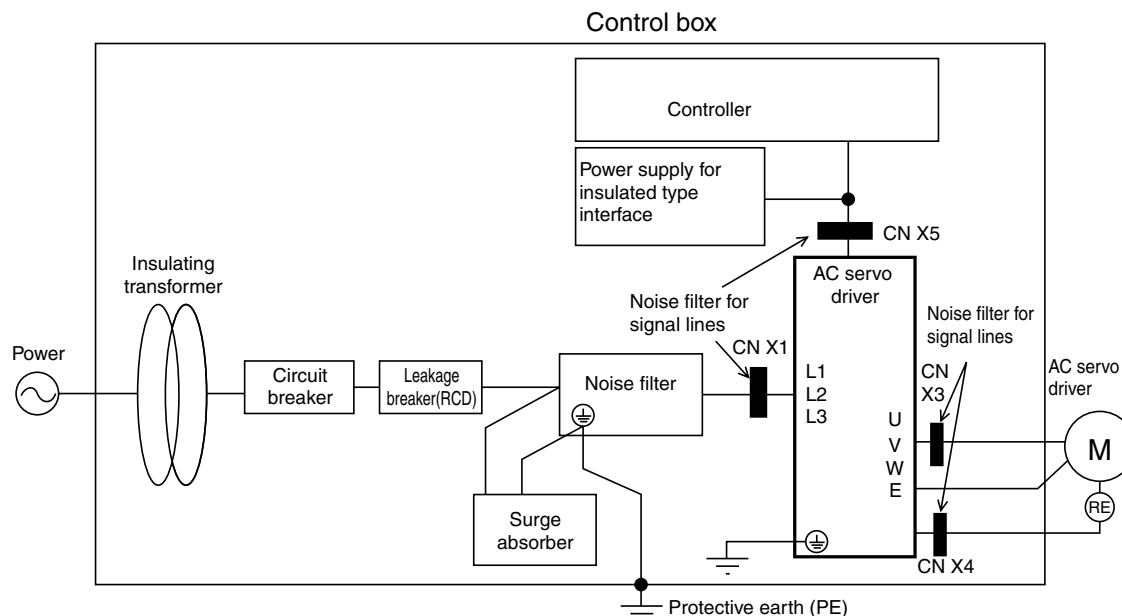
EN: Europäischen Normen

EMC: Electromagnetic Compatibility

Peripheral Equipment

Environment

The servo driver should be used under Contamination Level 2 or 1 specified by IEC60664-1 (housing the driver in an IP54 control box).



Power

Single-phase 100V:	Single-phase 100V	+ 10%	+ 10%
	- 15 % to 115V	- 15 %	50/60Hz
Single-phase 200V:	Single-phase 200V	+ 10%	+ 10%
	- 15 % to 240V	- 15 %	50/60Hz
Three-phase 200V:	Three-phase 200V	+ 10%	+ 10%
	- 15 % to 240V	- 15 %	50/60Hz

- Use under the environment of Over-voltage Category II specified by IEC60664-1
In order to realize the environment of overvoltage category II, install in the power supply input unit an insulating transformer that is compliant with ICE or EN standard (EN 60742).
- The power for interface should be marked CE or appropriate EN Standard type (EN60950), 12VDC to 24VDC, insulated.

Circuit Breaker

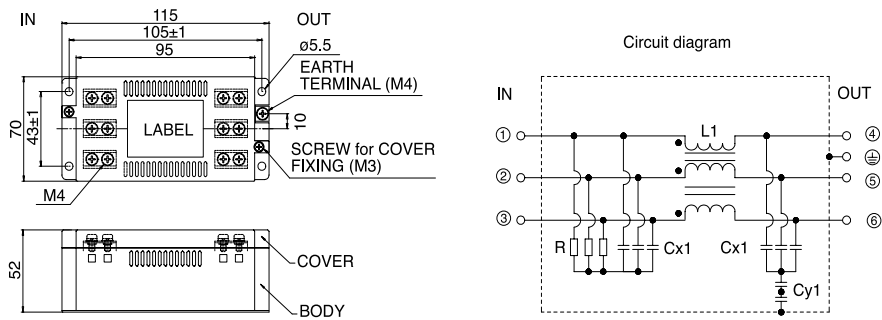
Install a circuit breaker between the power supply and noise filter. The circuit breaker should be IEC Standard and UL listed UL marked.

Conformance to EC Directives/UL Standards

Noise Filter

When, one set of noise filters is installed in the power unit with two or more drivers, be sure to consult with the noise filter manufacturer.

Option Part No.	Manufacturer's part No.	Manufacturer
DV0P4160	3SUP-HU10-ER-6	Okaya Electric Industries Co., Ltd.



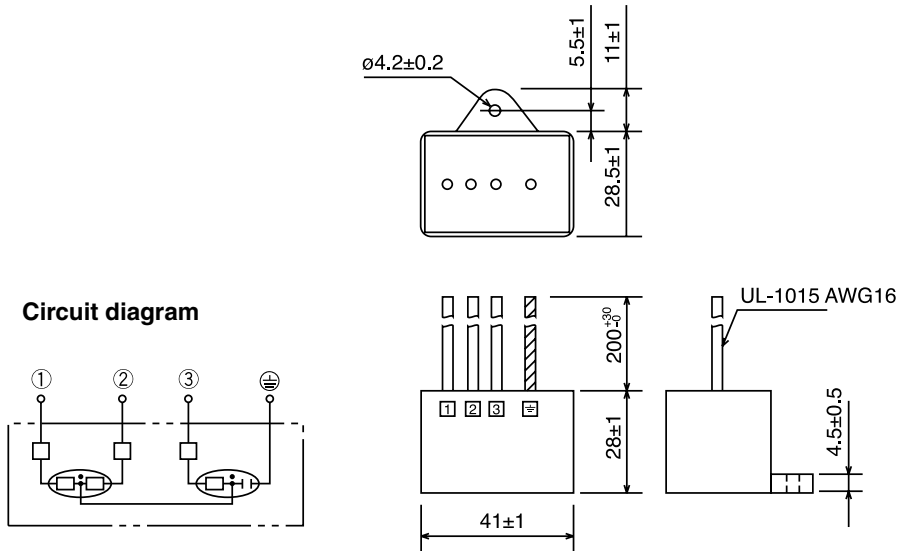
Surge Absorber

Install the surge absorber on the primary line of the noise filter.

<Note>

When conducting voltage-resistant test on the machine/equipment, remove the surge absorber.
Otherwise the absorber may be damaged.

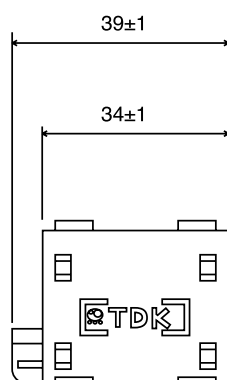
Option Part No.	Manufacturer's part No.	Manufacturer
DV0P1450	R•A•V-781BXZ-4	Okaya Electric Industries Co., Ltd.



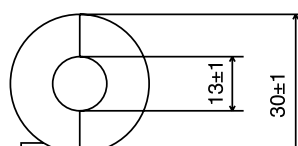
Noise Filter for Signal cables

Provide all the cables (power supply cable, motor cable, encoder cable, interface cable) with the noise filter for signal cable.

Option Part No.	Manufacturer's part No.	Manufacturer
DV0P1460	ZCAT3035-1330	TDK Co., Ltd.



Weight: 62.8 g



Grounding

- (1) Don't fail to connect the servo driver protective earth terminal (⊕) and the protective earth plate of the control panel together.
- (2) When connecting to the protective earth terminal (⊕), avoid co-clamping. Two protective earth terminals are provided.

Leakage Breaker

Connect Type-B leakage breaker (RCD) to the primary power supply of the servo driver.

Driver and Peripheral Devices Applied Thereto (EC Directives)

For the detail refer to “System Configuration and Wiring”, Page 26.

Install the noise filters in reference to DV0P4160 (page 182).

Conformance to UL Standards

The noise filters conform to UL508C (File No. E164620) to satisfy the following conditions.

- (1) The servo driver should be used under Contamination Level 2 or 1 specified by IEC60664-1 (housing the driver in an IP54 control box).
- (2) Install a circuit breaker or fuse between the power supply and noise filter. The circuit breaker or fuse should be a UL listed mark (UL) type.
The current rating of the circuit breaker or fuse should be per the table in page 26.

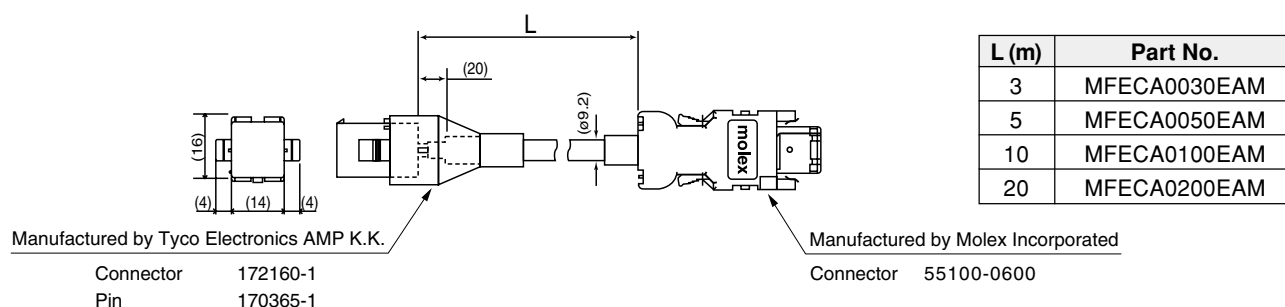
Optional Parts

MINAS-E Series Table of Junction Cable by Model

Figure No.	Motor Type	Junction Cable	Part No.
2-1	MUMA50W - 400W	For an encoder (2500 P/r 5 wires) Incremental	MFECAO * * OEAM
3-1		For a motor	MFMCAO * * OAEB
4-1		For a brake	MFMCBO * * OGET

Junction Cable for Encoder

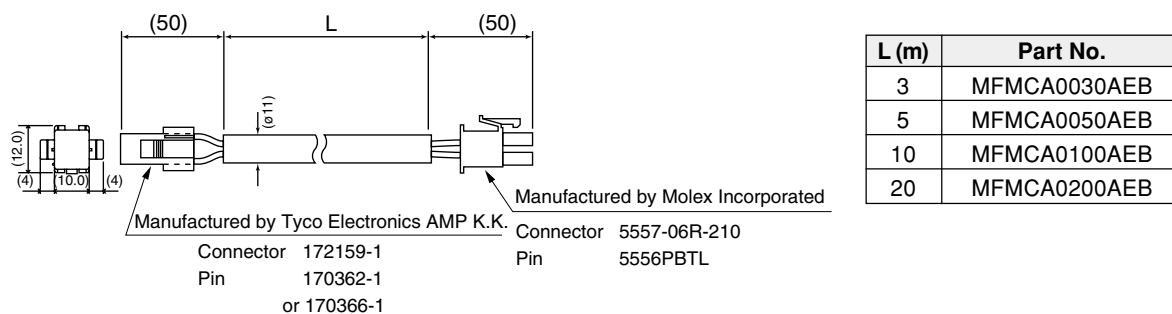
Figure 2-1 **MFECAO * * OEAM**



Junction Cable for Motors (Robotop® 600V DP)

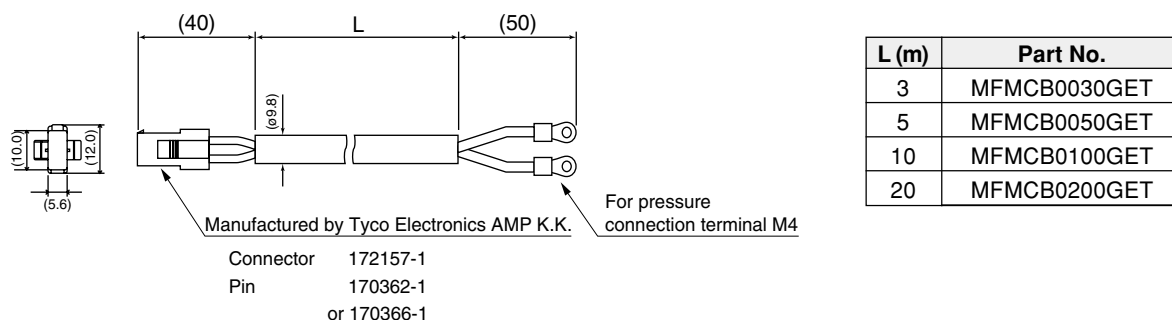
Figure 3-1 **MFMCAO * * OAEB**

Robotop® is a trade mark of Daiden Co., Ltd.



Junction Cable for Brakes (Robotop® 600V DP)

Figure 4-1 **MFMCBO * * OGET**



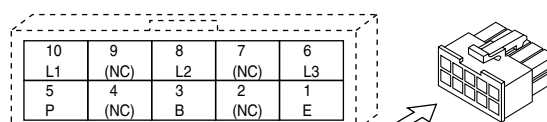
Connector Kits for Power Supply of the Driver

(1) Part No. DV0P2870

(2) Components

Name	Manufacturer's part No.	Number	Manufacturer	Remarks
Connector (10P)	5557-10R-210	1	Molex Incorporated	For connector CN X1 (pin 10)
Connector Pin	5556PBTL	6		

(3) Pin arrangement of connector for CN x 1



(4) Recommended manual pressure bonding tool
(Customers are requested to provide it by themselves.)

Manufacturer's part No.	Wire rod
57026-5000	UL1007
57027-5000	UL1015

<Cautions>

1. The above table shows arrangement of pins viewed from the pin inserting direction of the connector. Also check pin Nos. carved on the main body of the connector so as to avoid incorrect wiring.
2. For wiring and connection, refer to “System Configuration and Wiring”, Wiring of Main Circuits (Page 27).
3. You should leave a pin labeled with (NC) unconnected.

Optional Parts

Connector Kits for Connection of Motor and Encoder

- Used for: MUMA 50W to 400W Incremental
2500 pulse 5-wire

(1) Part No. DV0P3670

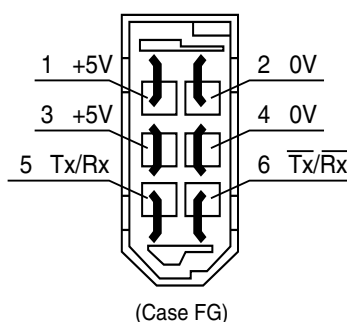
(2) Components

Name	Manufacturer's part No.	Number	Manufacturer	Remarks
Connector	55100-0600	1	Molex Incorporated	For connector CN X4 (pin 6)
Connector (6P)	172160-1	1	Manufactured by Tyco Electronics AMP K.K.	For junction of encoder cable (pin 6)
Connector pin	170365-1	6		
Connector (4P)	172159-1	1	Manufactured by Tyco Electronics AMP K.K.	For junction of motor power line (pin 4)
Connector pin	170366-1	4		
Connector (6P)	5557-06R-210	1	Molex Incorporated	For connector CN X3 (pin 6)
Connector pin	5556PBTL	4		

<Note>

You may use parts of other manufacturer equivalent to the above parts for such components as connector, connector cover, etc.

(3) Pin arrangement of connector CN X4 plug



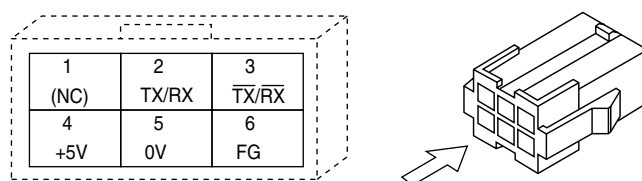
(4) Recommended manual pressure bonding tool
(A customer is requested to provide it by himself.)

Name	Manufacturer's part No.	Manufacturer	Wire rod
For junction of encoder cable	755330-1	Tyco Electronics AMP K.K.	—
For junction of motor power line	755331-1		
For connector CN X3	57026-5000	Molex Incorporated	UL1007
	57027-5000		UL1015

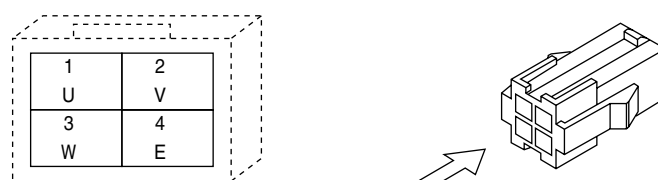
<Cautions>

- The above figure shows the pin arrangement viewed from the soldering side of the connector.
Also check pin Nos. carved on the main body of the connector so as to avoid incorrect wiring.
- Be sure to connect shield of the shielded wire to be used to the case (FG).
- For wiring and connection, refer to “System Configuration and Wiring”, Connector CNX4 (Page 29).

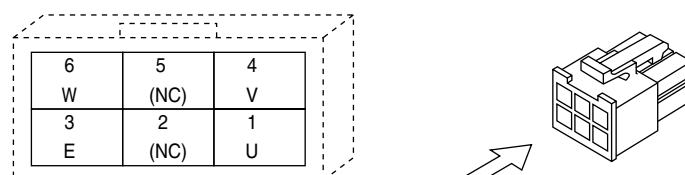
(5) Pin arrangement of connector for junction of encoder cable



(6) Pin arrangement of connector for junction of motor power line



(7) Pin arrangement of connector for connector CN X3



<Cautions>

1. The above table shows arrangement of pins viewed from the pin inserting direction of the connector. Also check pin Nos. carved on the main body of the connector so as to avoid incorrect wiring.
2. For wiring and connection, refer to “System Configuration and Wiring”, Wiring of Main Circuits (Page 27).

Optional Parts

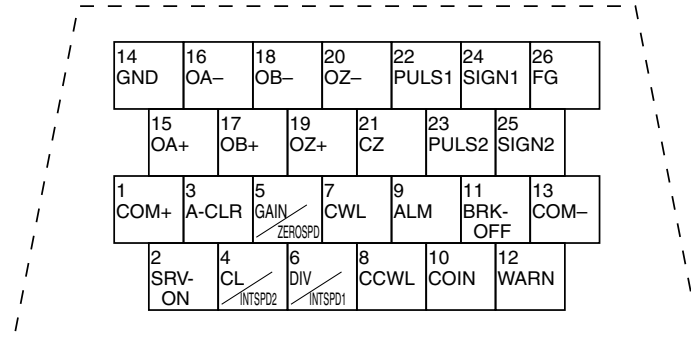
Connector Kit for Connection with Host Controller

(1) Part No. DV0P0770

(2) Components

Name	Manufacturer's part No.	Number	Manufacturer	Remarks
Connector	10126-3000PE	1	Sumitomo 3M Ltd	For CN X5 (Pin 26)
Connector Cover	10326-52A0-008	1		

(3) Pin arrangement of connector X5 (pin 26) (viewed from the soldering side of the connector)



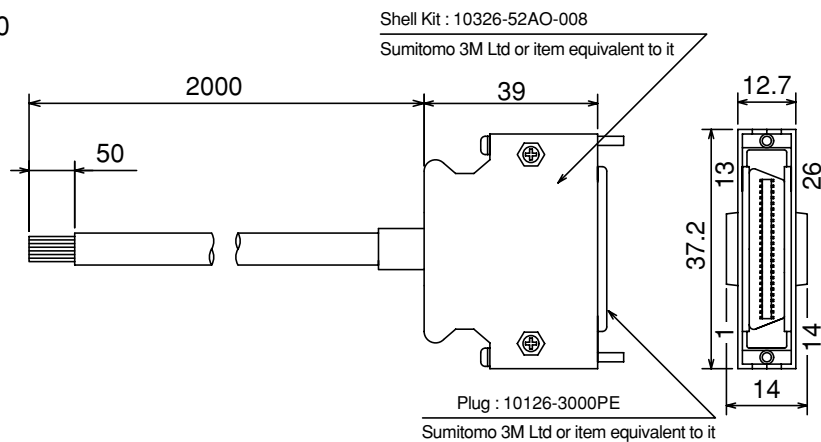
<Cautions>

1. When wiring, also check pin Nos. carved on the main body of the connector.
2. For codes representative of signal names in the above table or functions of signals, refer to Wiring to Connector CN X5 (Page 30, 67 and 105).

Interface Cable for Connection with Host Controller

(1) Part No. DV0P0800

(2) Outline dimension



(3) Table of Wiring

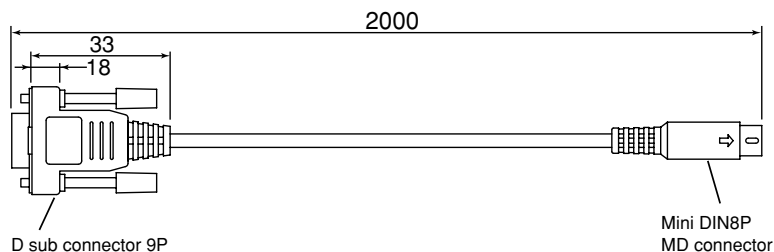
Pin No.	Signal Name	Color of Core Wire	Pin No.	Signal Name	Color of Core Wire	Pin No.	Signal Name	Color of Core Wire
1	COM+	Orange (red 1)	10	COIN	Pink (black 1)	19	OZ+	Pink (red 2)
2	SRV-ON	Orange (black 1)	11	BRK-OFF	Orange (red 2)	20	OZ-	Pink (black 2)
3	A-CLR	Gray (red 1)	12	WARN	Orange (black 2)	21	CZ	Orange (red 3)
4	CL/INTSPD2	Gray (black 1)	13	COM-	Gray (red 2)	22	PLUS1	Gray (red 3)
5	GAIN/ZEROSPD	White (red 1)	14	GND	Gray (black 2)	23	PLUS2	Gray (black 3)
6	DIV/INTSPD1	White (black 1)	15	OA+	White (red 2)	24	SIGN1	White (red 3)
7	CWL	Yellow (red 1)	16	OA-	White (black 2)	25	SIGN2	White (black 3)
8	CCWL	Yellow (black 1)	17	OB+	Yellow (red 2)	26	FG	Orange (black 3)
9	ALM	Pink (red 1)	18	OB-	Yellow (black 2)			

<Remarks>

- For example, the color of the wire, Orange (Red 1) means that the lead wire is colored in orange with one red dot mark.
- The shield of this cable is not connected with the terminal of the connector.
Please use the connector kit for connection with Host Controller when you connect the shield with FG or GND on the driver side.

Communications Cable (Connection with Personal Computer)

(1) Part No. DV0P 1960 (for DOS/V compatible machines)



For pin arrangement of CN X6, see Page 159.

“PANATERM®”, software for communications control

(1) Part No. DV0P4230 (Japanese version) DV0P4240 (English version)

(2) This is supplied in the form of a 3.5 inch floppy disk.

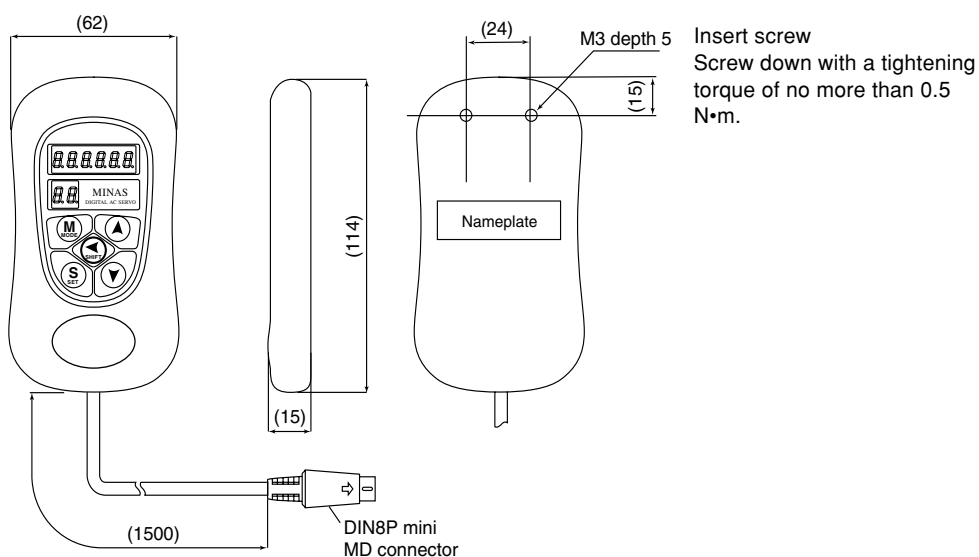
<Cautions>

For details on the operating environment or others, refer to the operating instructions of “PANATERM®”.

For information on latest version, please contact us.

Console

Part No. DV0P3690



Optional Parts

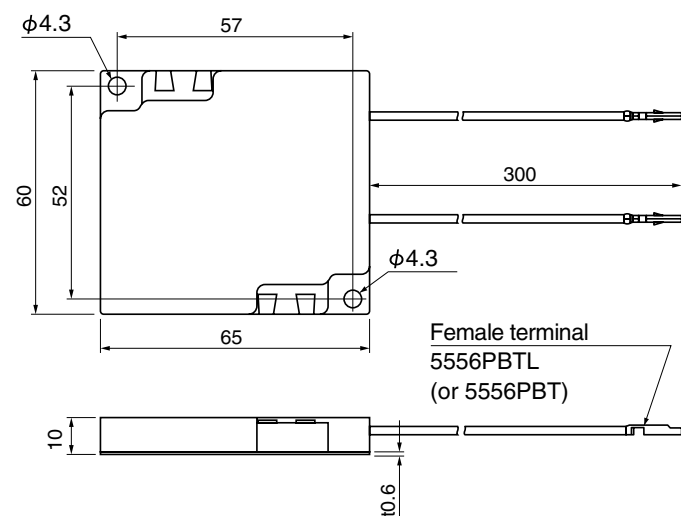
External Regenerative Resistor

Part No.	Manufacturer's model name	Specification			Remarks (Specifications for the driver voltage)
		Ohmic Value	Rated Power	Operating Temperature for Built-in Temperature Fuse	
DV0P2890	45M03	50 Ω	10W	130 \pm 2°C	For single-phase 100V
DV0P2891	45M03	100 Ω	10W	130 \pm 2°C	For single-phase/ three-phase 200V

Manufactured by: IWAKI MUSEN KENKYUSHO CO., LTD.

<Note>

For safety reasons, the external regenerative resistor has a built-in temperature fuse. The built-in temperature fuse may be disconnected depending on heat dissipation conditions, range of use temperatures, supply voltage, and load variations.



<Cautions>

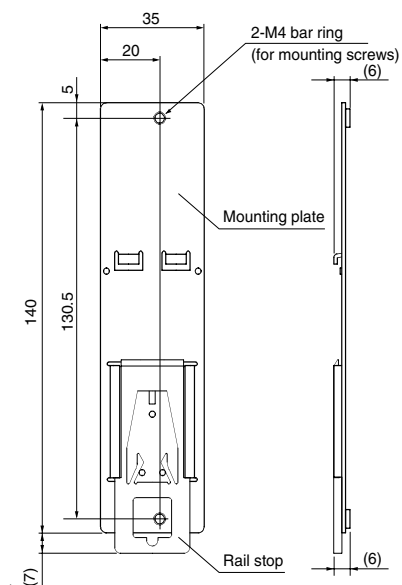
The regenerative resistor may be hot.

Take preventive actions against a fire and burn.
Do not mount the regenerative resistor in the vicinity of an inflammable object or in a place where an operator may easily touch it by hand.

DIN Rail Mounting Unit

(1) Part No. DV0P3811

(2) Outline Dimension



<Remarks>

- Two mounting screws (M4 x length 8, pan head machine screws) are supplied.
- * When extended, the rail stopper is 10mm long.

<Note>

For installation and removal, refer to "Installation" of Before Use edition on Pages 18 to 19.

Reactor

Driver Outline Frame Code	Voltage Specification for Power Source of Driver	Rated Output	Reactor Part No.	Figure
MKDE	Single-phase 100V	50 - 100W	DV0P227	1
	Single-phase 200V	50 - 100W	DV0P220	2
	Three-phase 200V	50 - 200W		
MLDE	Single-phase 100V	200W	DV0P228	1
	Single-phase 200V	200 - 400W	DV0P220	2
	Three-phase 200V	400W		

Figure 1

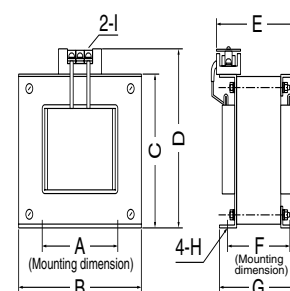


Figure 2

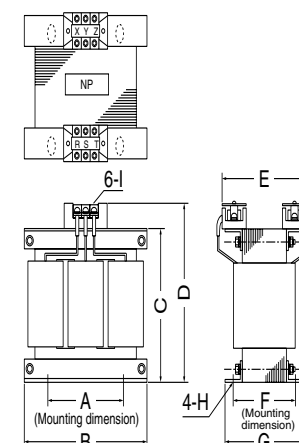


Figure	Part No.	A	B	C	D	E	F	G	H	I	Inductance (mH)	Rated Current (A)
1	DV0P227	55	80	68	90	90	41	55	ø 7	M4	4.02	5
	DV0P228										2	8
2	DV0P220	65	125	83	118	145	70	85	Width 7 x Length 12	M4	6.81	3

- The former Agency of Natural Resources and Energy of Ministry of International Trade and Industry (present Ministry of Economy, Trade and Industry) established higher harmonics suppression guidelines in September 1994.
 - Drivers rated 4kW or lower are subject to “Higher Harmonics Suppression Guidelines for Home Electric and General Purpose Appliances”.
 - Drivers rated over 4kW are subject to “Higher Harmonics Suppression Guidelines for High Voltage and Special Customers”.
- The Ministry of Economy, Trade and Industry strongly demands manufacturers to enforce measures to curb harmonics.

In order to comply with the established regulatory level, connect a power-factor improvement reactor (L) to drivers of 4 kW or lower. For drivers of over 4kW, determine the level of harmonics according to the guideline and take a suppression measure, as appropriate.

<Reference>

[Harmonics Suppression Technical Guideline], JEAG 9702-1995, Japan Electric Association

[Harmonic Current Calculation Procedure for General-purpose Inverter at Special Customers], JEM-TR201-1996, Japan Electrical Manufacturers' Association

Recommended Parts

Surge Absorber for Motor Brake

Motor	Surge Absorber for Motor Brake
MUMA50W - 400W	<ul style="list-style-type: none"> C-5A2 or Z15D151 Ishizuka Electronics Corporation

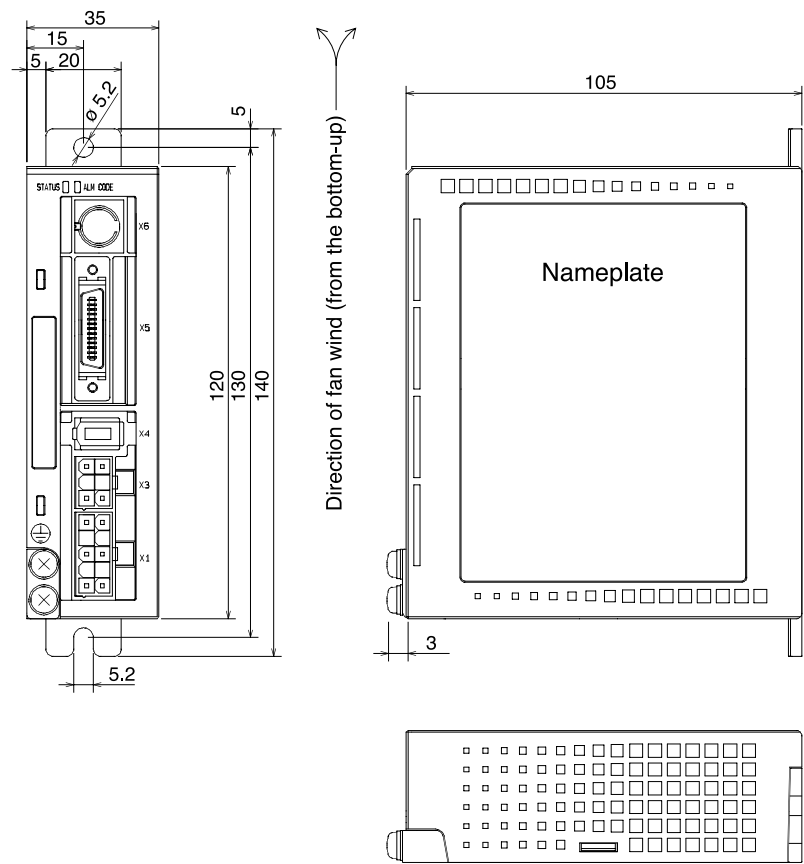
- The recommended parts are specified items to measure the brake release time.

List of Manufacturers of Peripheral Equipment

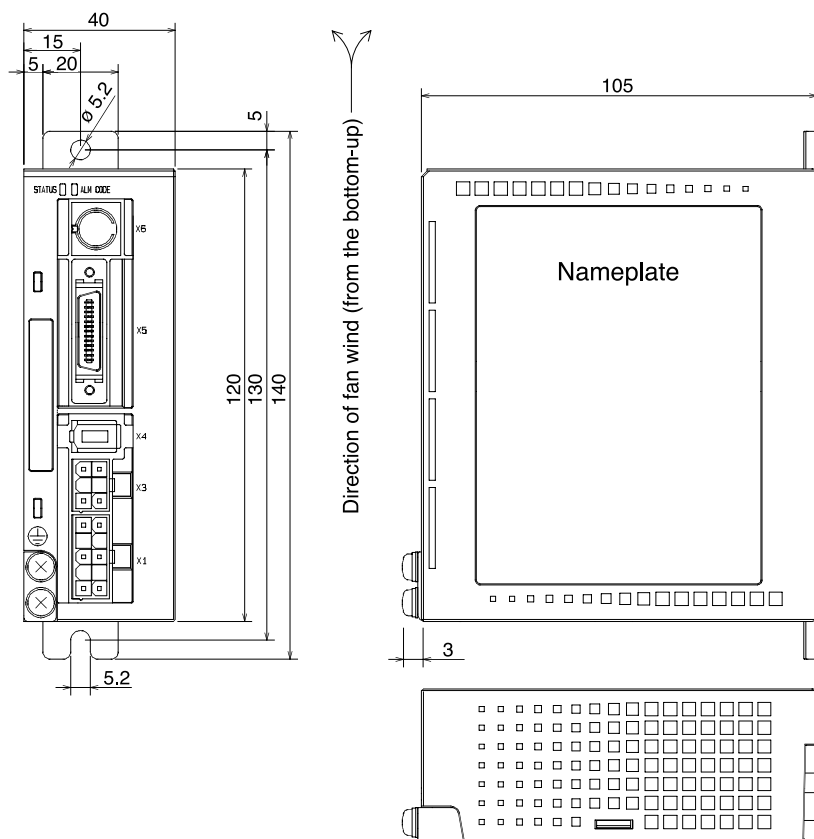
As of February 2003

Manufacturer/Agent	Phone Number	Equipment
Matsushita Electric Works, Ltd. Automation Controls Company	+81-6-6908-1131 http://www.mew.co.jp	No-fuse breaker Electromagnetic switch Surge absorber
IWAKI MUSEN NKENKYUSHO CO., LTD.	+81-44-833-4311 http://www.iwakimusen.co.jp/	Regenerative resistor
Ishizuka Electronics Corporation	+81-3-3621-2703 http://www.semitec.co.jp/	Surge absorber for holding brake
Renesas Technology Corporation.	+81-6-6233-9511 http://www.renesas.com/jpn/	
TDK Corporation	+81-3-5201-7229 http://www.tdk.co.jp/	Noise filter for signal line
Okaya Electric Industries, Co., Ltd.	+81-3-3424-8120 http://www.okayatec.co.jp/	Surge absorber Noise filter
Sumitomo 3M Ltd	+81-3-5716-7290 http://www.mmmco.jp	Connector
Tyco Electronics AMP K.K.	+81-44-844-8111 http://www.tycoelectronics.com/japan/amp	
Japan Molex Incorporated	+81-462-65-2313 http://www.molex.co.jp	
Daiden Co., Ltd.	+81-3-5805-5880 http://www.dyden.co.jp	Cable

Driver (Frame K) Estimated Mass 0.35 kg



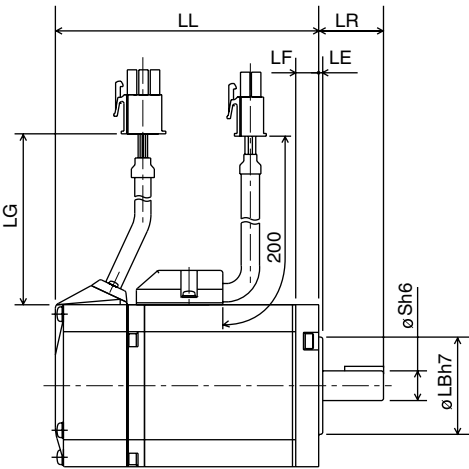
Driver (Frame L) Estimated Mass 0.4 kg



Dimensional Outline Drawing

Motor

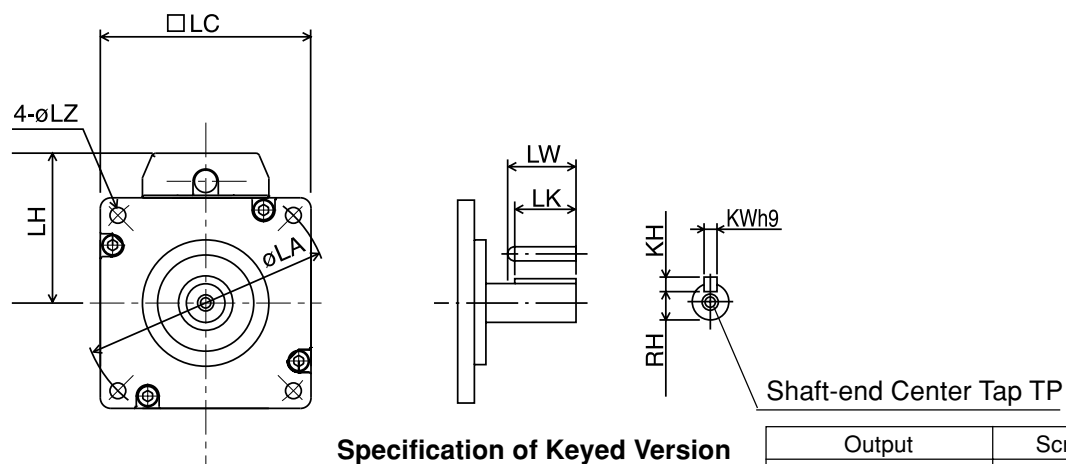
MUMA Series 50W to 400W



Output	LG
50W, 100W	230mm
200W, 400W	220mm

(Unit: mm)

		Model	Output (W)	LL	S	LB	LE	LF	LR
MUMA	Without a brake	MUMA5A □ P1 □	50	75.5	8	22	2	7	24
		MUMA01 □ P1 □	100	92.5					
		MUMA02 □ P1 □	200	96	11	50	3		30
		MUMA04 □ P1 □	400	124	14				
	With a brake	MUMA5A □ P1 □	50	107	8	22	2	7	24
		MUMA01 □ P1 □	100	124					
		MUMA02 □ P1 □	200	129	11	50	3		30
		MUMA04 □ P1 □	400	157	14				



**Specification of Keyed Version
(Dimension)**

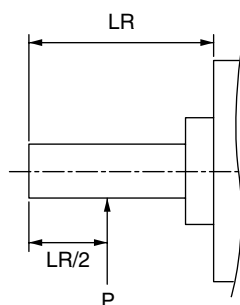
Output	Screw	Depth
50W, 100W	M3	6
200W	M4	8
400W	M5	10

(Unit: mm)

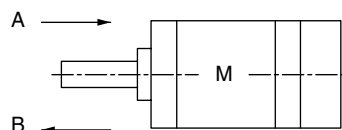
		LA	LC	LZ	LW	LK	KW	KH	RH	LH	Mass (kg)	Rotor Moment of Inertia (x10 ⁻⁴ kg·m ²)
MUMA	Without a brake	48	42	3.4	14	12.5	3	3	6.2	34	0.40	0.021
											0.50	0.032
		70	60	4.5	20	18	4	4	8.5	43	0.96	0.10
											1.5	0.17
	With a brake	48	42	3.4	14	12.5	3	3	6.2	34	0.60	0.026
											0.70	0.036
		70	60	4.5	20	18	4	4	8.5	43	1.4	0.13
											1.9	0.20

Allowable Load of Output Shaft

Radial Load Direction (P)



Thrust Load Directions (A, B)

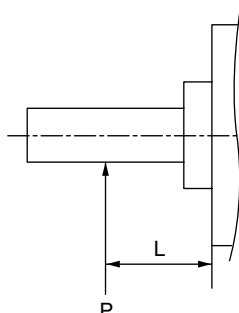


Unit: N (1kgf = 9.8N)

Motor Series	Motor Output	When Assembled			In Operation	
		Radial Load	Thrust Load		Radial Load	Thrust Load Directions A, B
			Direction A	Direction B		
MUMA	50W, 100W	147	88.2	117.6	68.6	58.8
	200W, 400W	392	147	196	245	98

<Remarks>

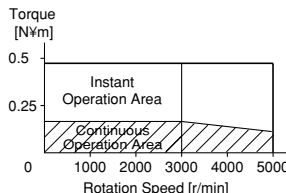
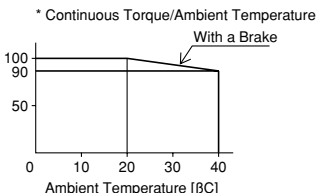
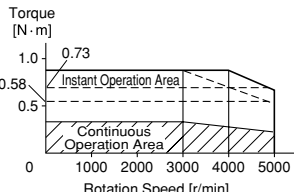
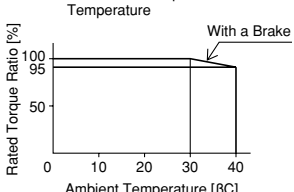
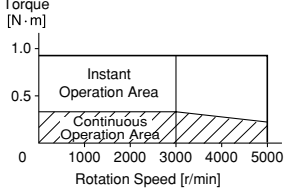
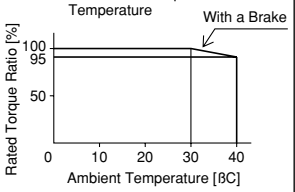
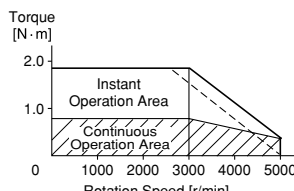
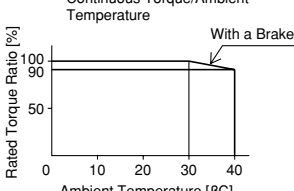
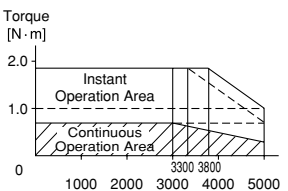
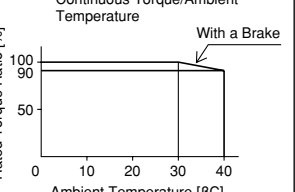
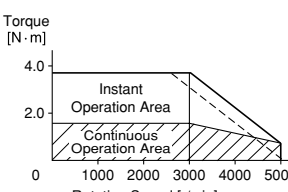
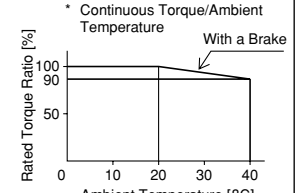
If a position of load point varies, calculate allowable radial load P (N) from distance L (mm) of a load point from mounting flange face, based on the relational expression, so that the result of calculation will be as follows:



Motor Series	Motor Output	Relational Expression of Load - Load Point
MUMA	50W, 100W	$P = \frac{1406}{L + 7.5}$
	200W	$P = \frac{2940}{L - 3}$
	400W	$P = \frac{5831}{L + 8.8}$

Motor Characteristics (S-T Characteristics) [Reference]

- Note that motor characteristics may vary depending on whether or not there is a brake.
- The continuous torque — ambient temperature characteristic shows a value when our standard flange made of aluminum (having about doubled angle of that of the motor flange) is mounted.
- They are characteristics without an oil seal.

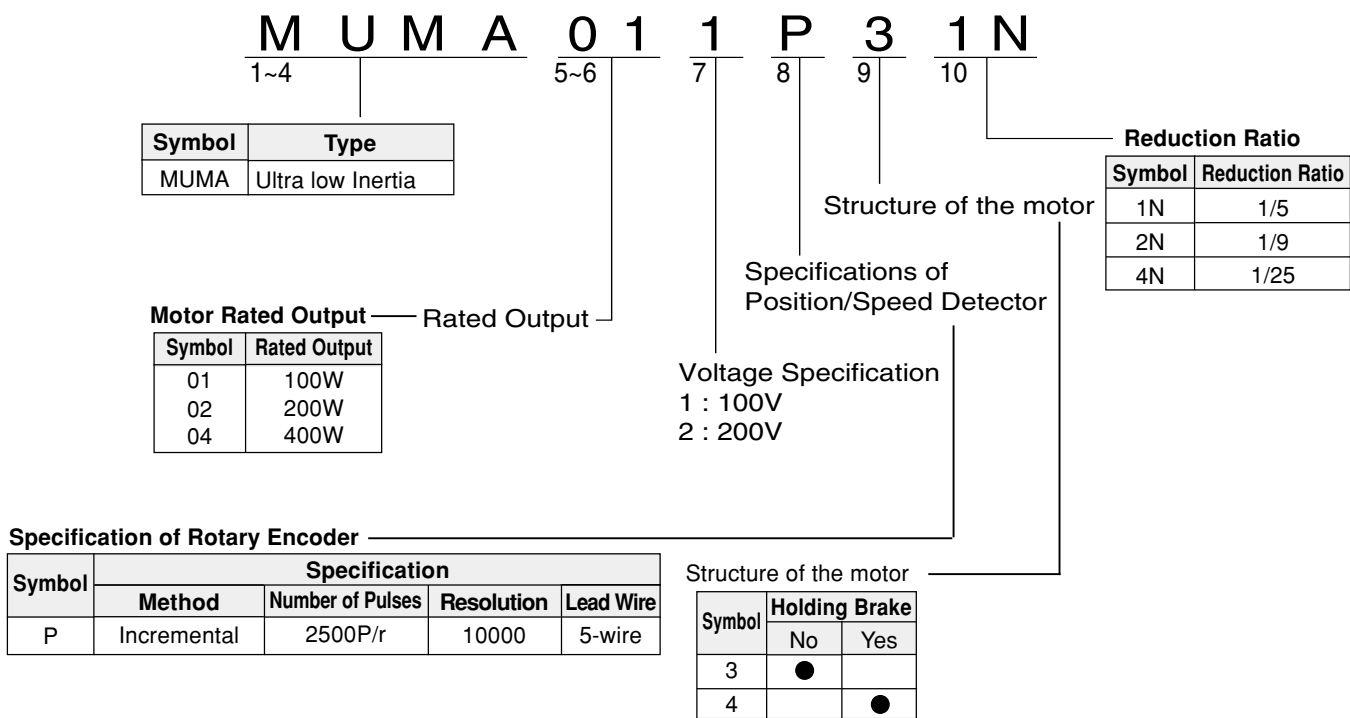
Motor Capacity	Supply Voltage of Driver	
	AC100V	AC200V
50W	<p>● MUMA5AZP1 □ Supply Voltage of Driver: At AC100V/200V</p> <div style="display: flex; justify-content: space-around;">   </div>	
100W	<p>● MUMA011P1 □ Supply Voltage of Driver: AC100V (A dotted line indicates the case in which the supply voltage drops by 10%.)</p> <div style="display: flex; justify-content: space-around;">   </div>	<p>● MUMA012P1 □ Supply Voltage of Driver: AC200V</p> <div style="display: flex; justify-content: space-around;">   </div>
200W	<p>● MUMA021P1 □ Supply Voltage of Driver: AC200V (A dotted line indicates the case in which the supply voltage drops by 10%.)</p> <div style="display: flex; justify-content: space-around;">   </div>	<p>● MUMA022P1 □ Supply Voltage of Driver: AC200V (A dotted line indicates the case in which the supply voltage drops by 10%.)</p> <div style="display: flex; justify-content: space-around;">   </div>
400W	<p>● MUMA042P1 □ Supply Voltage of Driver: AC200V (A dotted line indicates the case in which the supply voltage drops by 10%.)</p> <div style="display: flex; justify-content: space-around;">   </div>	

* In the case of no oil seal and no brake, the rated torque ratio is 100% at ambient temperature of 40°C.

Servo Motor with Gear

Checking Model of Servo Motor with Gear

How to check the model



Check the Combination of Driver and Motor with Gear

This driver was designed for use with the motor designated by us.

Check a name of the series, rated output, voltage specification, and encoder specification of the motor you plan to use.

Incremental Specification 2500 P/r

<Note>

You must not use any combination other than those listed below.

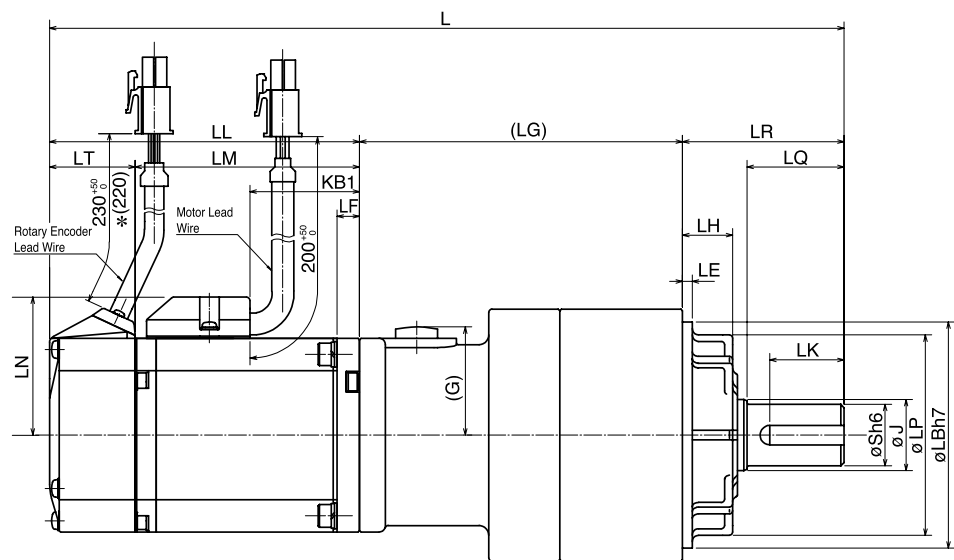
Power Supply	Applicable Motors with Gear				Applicable Drivers	
	Motor Rated Output	Reduction Ratio 1/5	Reduction Ratio 1/9	Reduction Ratio 1/25	Driver Model	Driver Frame
Single Phase 100V	100W	MUMA011P * 1N	MUMA011P * 2N	MUMA011P * 4N	MKDET1110P	Frame K
	200W	MUMA021P * 1N	MUMA021P * 2N	MUMA021P * 4N	MLDET2110P	Frame L
Single Phase 200V	100W	MUMA012P * 1N	MUMA012P * 2N	MUMA012P * 4N	MKDET1505P	Frame K
	200W	MUMA022P * 1N	MUMA022P * 2N	MUMA022P * 4N	MLDET2210P	Frame L
	400W	MUMA042P * 1N	MUMA042P * 2N	MUMA042P * 4N	MLDET2510P	
Three-Phase 200V	100W	MUMA012P * 1N	MUMA012P * 2N	MUMA012P * 4N	MKDET1505P	Frame K
	200W	MUMA022P * 1N	MUMA022P * 2N	MUMA022P * 4N	MKDET1310P	
	400W	MUMA042P * 1N	MUMA042P * 2N	MUMA042P * 4N	MLDET2310P	Frame L
					MLDET2510P	

<Remarks>

- The mark "***" under the model name of the applicable motors refer to the structure of motor.

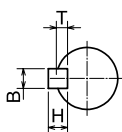
Dimensional Outline Drawing of Motor with Gear

Servo Motor with Gear

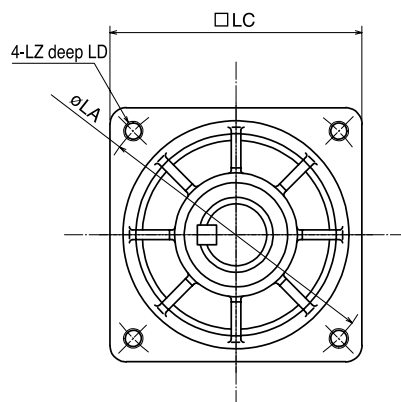


* 220 refers to 200W or higher.

		(unit: mm)																		
		Model	Motor Output	Reduction Ratio	L	LL	LM	LT	KB1	LF	LR	LQ	LB	S	LP	LH	J	(LG)	LE	(G)
MUMA	Without a brake	MUMA01□P31N	100W	1/5	192	92.5	64	28.5	38.8	7	32	20	50	12	45	10	14	67.5	3	25
		MUMA01□P32N		1/9																
		MUMA01□P34N		1/25																
		MUMA02□P31N	200W	1/5	200.5	96	69.5	26.5	34		32	20	50	12	45	10	14	72.5		34
		MUMA02□P32N		1/9	235.5															
		MUMA02□P34N		1/25	246															
		MUMA042P31N	400W	1/5	263	123.5	97	61.5	50		30	70	19	62	17	22	89.5	34		
		MUMA042P32N		1/9																89.5
		MUMA042P34N		1/25																100
	With a brake	MUMA01□P41N	100W	1/5	223.5	124	95.5	28.5	38.8	7	32	20	50	12	45	10	14	67.5	3	25
		MUMA01□P42N		1/9																
		MUMA01□P44N		1/25																
		MUMA02□P41N	200W	1/5	233.5	129	102.5	26.5	34		32	20	50	12	45	10	14	72.5		34
		MUMA02□P42N		1/9	268.5															
		MUMA02□P44N		1/25	279															
		MUMA042P41N	400W	1/5	296	156.5	130	61.5	50		30	70	19	62	17	22	89.5	34		
		MUMA042P42N		1/9																89.5
		MUMA042P44N		1/25																104



Detailed View of Shaft End



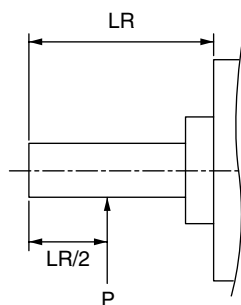
(unit: mm)

		LC	LA	LZ	LD	Key Dimensions (B × H × LK)	T	LN	Mass (kg)	Moment of Inertia (×10 ⁻⁴ kg·m ²)
MUMA	Without a brake	52	60	M5	12	4 × 4 × 16	2.5	34	1.05	0.072
										0.0663
		78	90	M6	20	6 × 6 × 22	3.5		2.20	0.0645
		52	60	M5	12	4 × 4 × 16	2.5	43	1.68	0.218
		78	90	M6	20	6 × 6 × 22	3.5		2.66	0.368
										0.388
									3.2	0.533
	3.2	0.438								
	98	115	M8		8 × 7 × 30	4	4.7	0.470		
	With a brake	52	60	M5	12	4 × 4 × 16	2.5	34	1.25	0.076
										0.0703
		78	90	M6	20	6 × 6 × 22	3.5		2.40	0.0685
		52	60	M5	12	4 × 4 × 16	2.5	43	2.08	0.248
		78	90	M6	20	6 × 6 × 22	3.5		3.06	0.398
0.418										
3.6									0.563	
	0.468									
98	115	M8		8 × 7 × 30	4	5.1	0.500			

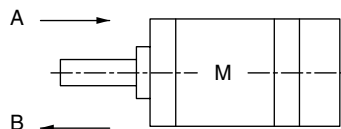
A value of moment of inertia is a motor shaft converted value (of the motor + speed reducer).

Allowable Load of Output Shaft of Servo Motor with Gear

Radial Load (P) Direction



Thrust Loading (A, B) Direction



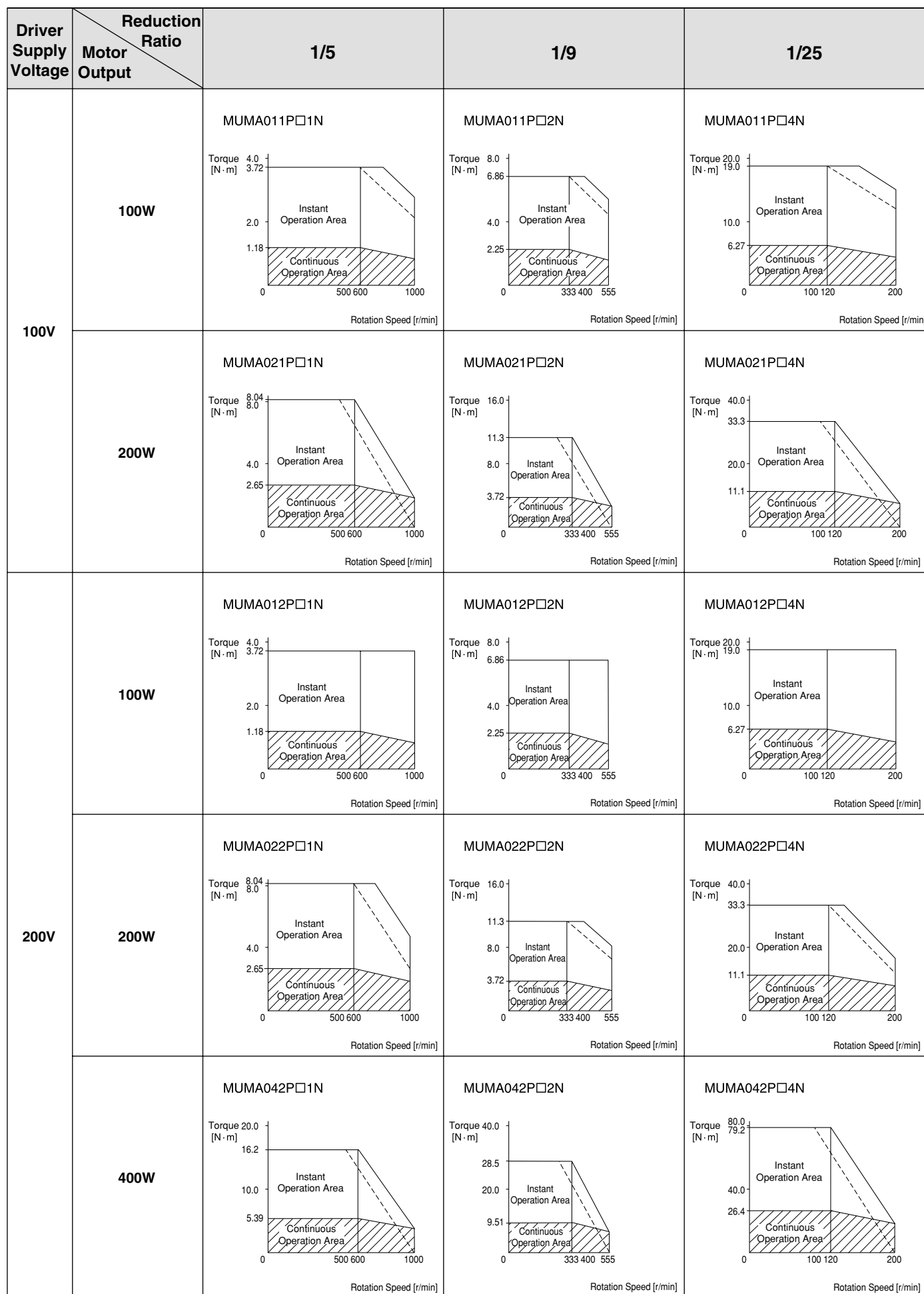
Unit: N

Motor Output	Gear Ratio	Shaft Allowable Load	
		Radial Load	Thrust Load A, B directions
100W	1/5	490	245
	1/9	588	294
	1/25	1670	833
200W	1/5	490	245
	1/9	1180	588
	1/25	1670	833
400W	1/5	980	490
	1/9	1180	588
	1/25	2060	1030

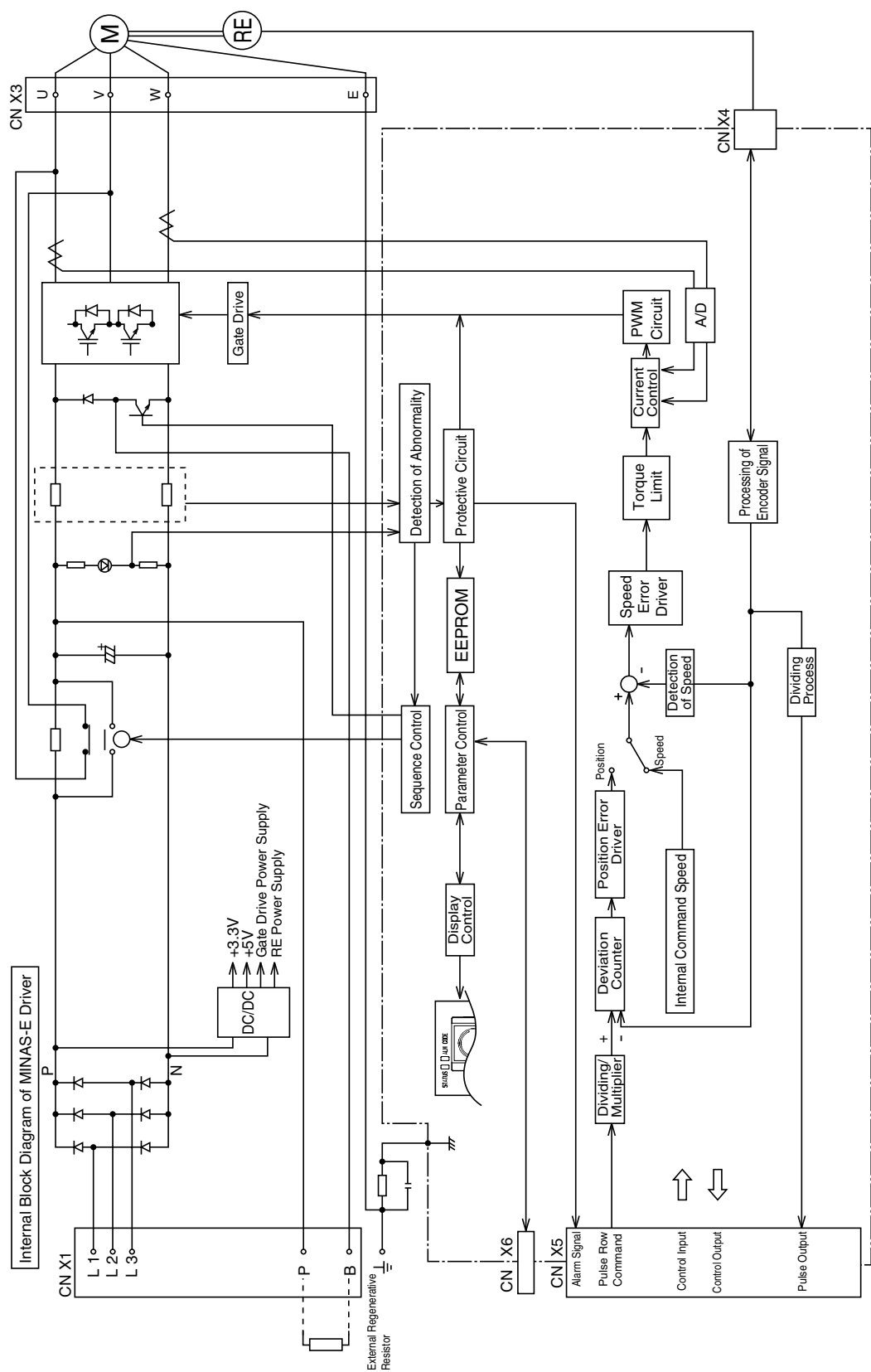
Requests Concerning Installation

- (1) Do not tap on the shaft when mounting the pulley, sprocket, etc. to the output shaft of the gear head. If you do tap on it, you may hear abnormal sound.
- (2) Give load to the pulley, sprocket, etc., so that force can act on the root of the output shaft, whenever possible.
- (3) If you plan to use a rigid coupling, ask us for information on the mounting precision and strength.
- (4) The motor has a built-in detector. If you inadvertently give excessive shock to the motor unit when coupling it with a device, the detector may be broken. Thus, assemble it carefully.

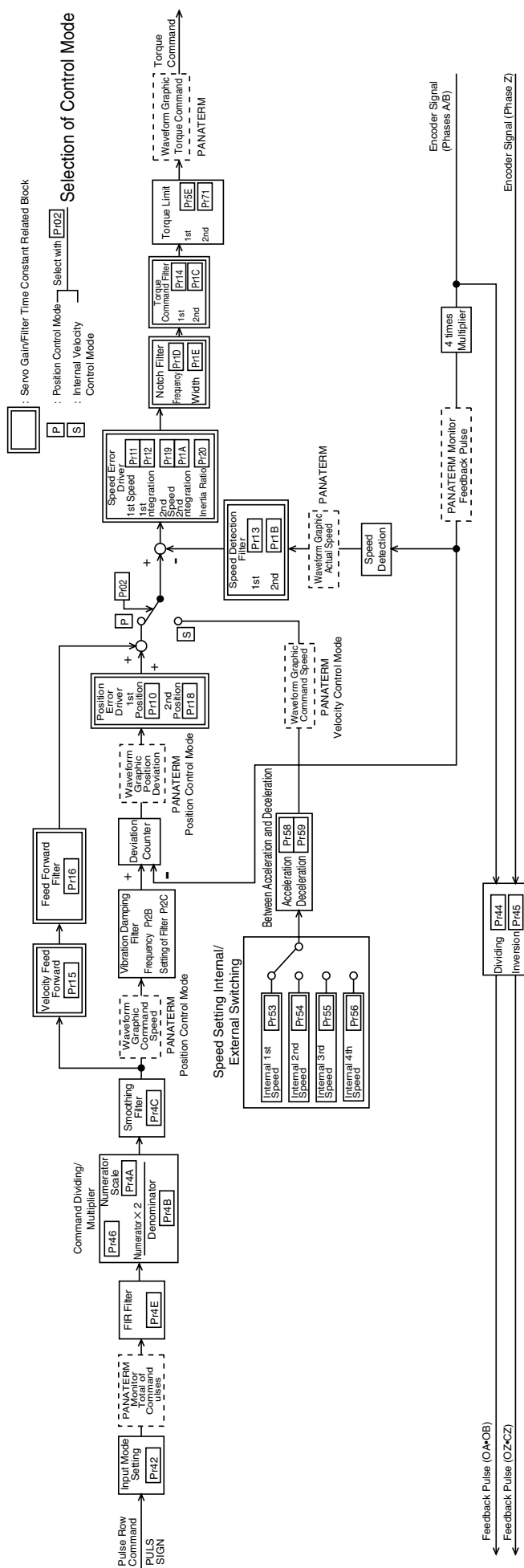
Characteristics of Servo Motor with Gear (S-T Characteristics) [Reference]



Driver Internal Block Diagram



● Control Block Diagram



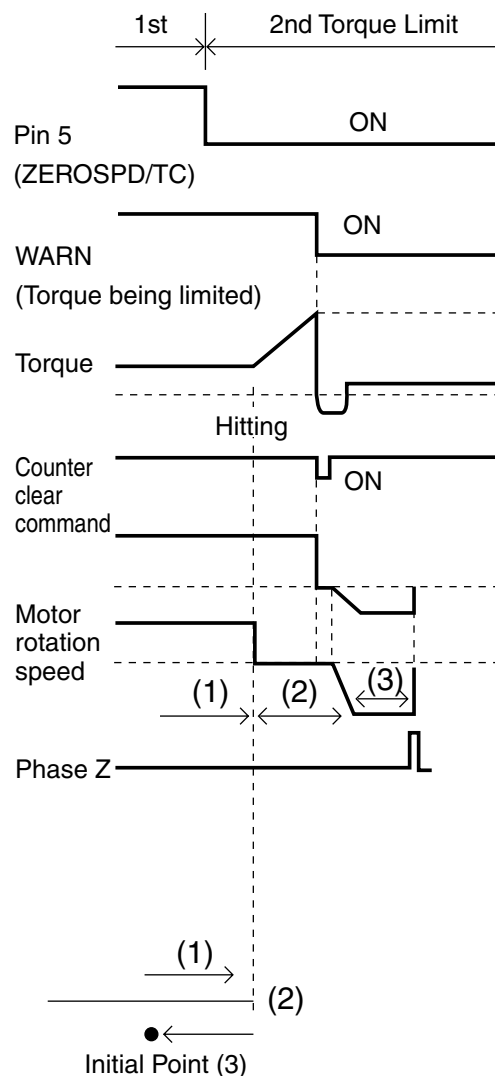
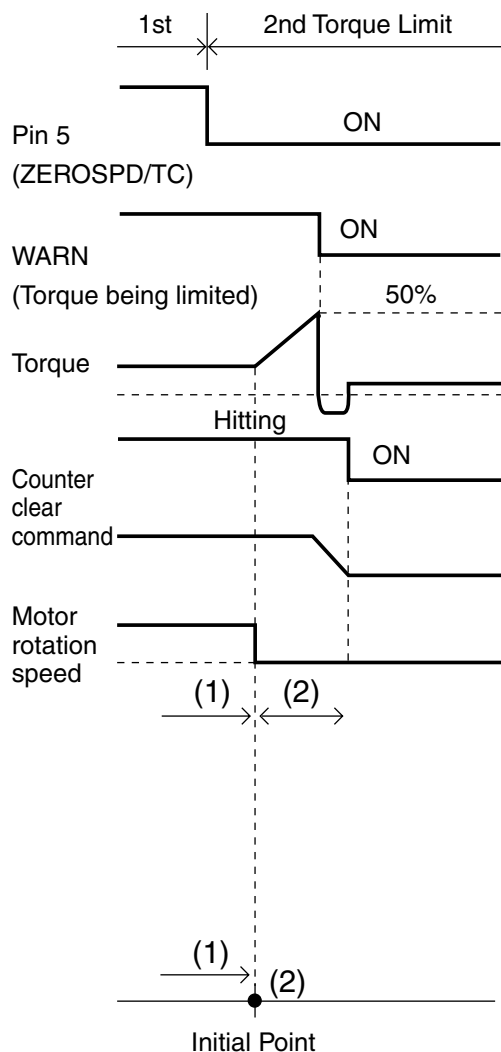
Specifications

Driver	Power Supply	Single-phase 100V		Single-phase AC100V	+10% —15%	115V	+10% —15%	50/60Hz	
		Single-phase 200V		Single-phase AC200V	+10% —15%	240V	+10% —15%	50/60Hz	
		Three-phase 200V		Three-phase AC200V	+10% —15%	240V	+10% —15%	50/60Hz	
		Allowable frequency variations		Within –5%					
	Control method			IGBT transistor PWM control (Sine wave driving)					
	Detector	Specification of applicable rotary encoder			Incremental encoder 5-wire 2500 P/r				
	Built-in functions	Regeneration			Externally installed regenerative resistor				
		Dynamic brake			At power-off, Servo-OFF, activation of protective function, and activation of limit switches				
		Auto gain tuning			Normal, real time				
		Electronic gear (Dividing/multiplier of a command pulse)			A value resulting from the calculation of $\frac{1 - 10000}{1 - 10000} \times 2^{0 - 17}$				
		Dividing of feedback pulse			Two-phase pulse of 5 to 2500 P/r output at any number of pulse				
	Protective Function	Capable of storing 14 alarms including a current alarm code No. Note, however, that alarm marked with * cannot be stored.			Undervoltage*, overvoltage, overcurrent, overload, regenerative overload, encoder error, position over-deviation, over-speed, command pulse dividing error, position deviation overflow, EEPROM data error* (abnormal parameter, abnormal check code), overtravel input error*, etc.				
	Monitor	Panel Display			Status LED (STATUS), alarm code LED (ALM CODE)				
	Setting	Communications			RS232C				
	Position Control	Maximum Input Pulse Frequency			Line driver 500 kpps, open collector 200 kpps				
		Form			Line driver, open collector				
		Type			90° phase difference two-phase pulse, CW/CCW pulse, pulse row + sign				
	Velocity Control	Internal command speed			Four-speed setup (Capable of setting CW/CCW, up to 20000r/min. However, use it within the use range of the motor.)				
		Acceleration time setting			0 to 10 s/1000r/min, possible to individually set acceleration/ deceleration.				
	Rotary Encoder	Rotary encoder feedback signal	Phases A•B		Line driver output				
			Phases Z		Line driver output, Open collector output				
	Control Input				Refer to Section "System Configuration and Wiring".				
	Structure				Base mount type, open (IPOO)				
	Mass				Refer to Section "Dimensional Outline Drawing of Driver".				
	Ambient Conditions				Refer to Section "Installation".				
Motor	Rated Rotation Speed			3000r/min					
	Maximum Rotation Speed	100V		50W - 200W: 5000r/min					
		200V		50W - 400W: 5000r/min					
	Holding Brake			Refer to Section "Holding Brake Built in the Servo Motor" for DC24V.					
	Rotary Encoder			Incremental encoder 5-wire 2500 P/r					
	Structure (dust-proof/drip-proof protection)			Equivalent to IP65 (excluding connector unit, shaft-through part)					
	Mass			Refer to Section "Dimensional Outline Drawing".					
Ambient Conditions				Refer to Section "Installation".					

Hit-and-stop Initialization

When you find it difficult to install a sensor as the surroundings are not good, Hit-and-stop Initialization can be used.

- (1) When you set a point where the motor hits, as the origin:
- (2) When you stop the motor using phase Z with the hit point as a starting point, and make it an origin



Parameter No.	Name	Example of Settings
70	1st over-speed level set-up	6000
71	2nd torque limit set-up	50 (Set it 100% or less)
72	2nd position over-deviation set-up	1875 (Same as No.1)
73	2nd over-speed level set-up	6000
06	ZEROSPD/TC input selection	2 (Speed zero clamp disabled. Torque limit switching input enabled.)
09	Warning output selection	0 (Torque being limited)

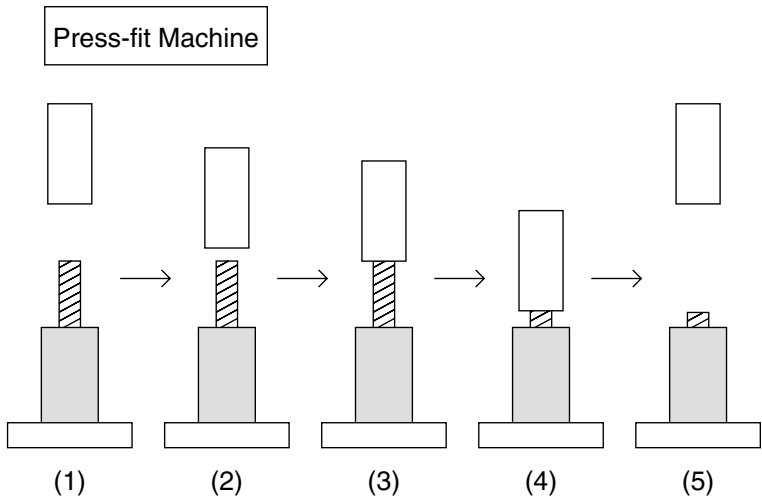
<Note>

Set pin 5 "H (OFF)" after hit-and-stop initialization completes.

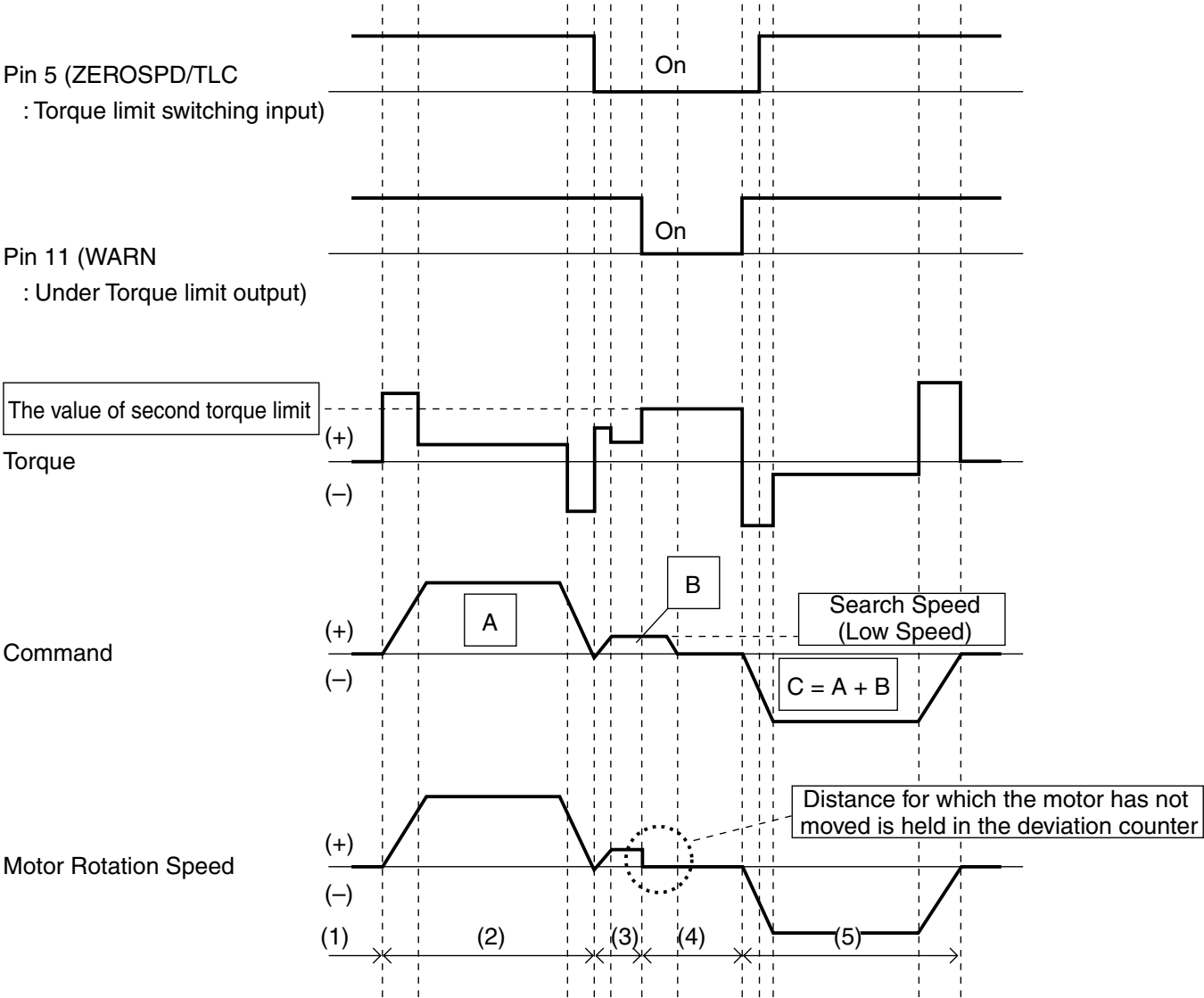
Hit-and-stop Initialization and Load Pressing Control

Load Pressing Control

Example of Application



PrNo.	Name	Example of Settings
06	ZEROSPD/TC input selection	2
09	Warning output selection	0
5E	Torque limit set-up	200
70	1st over-speed level set-up	3000
71	2nd torque limit set-up	50
72	2nd over-position deviation set-up	10000
73	2nd over-speed level set-up	3000



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This image shows a full page of white paper with horizontal grey ruling lines. The word "MEMO" is printed at the top center in a bold, black, sans-serif font. Below the title, there are approximately 28 evenly spaced horizontal lines extending across the width of the page, providing a template for writing.

After-Sale Service (Repair)

Repair

- Ask the seller where the product was purchased for details of repair work.
When the product is installed in a machine or device, consult first the manufacture of the machine or device.

Cautions for Proper Use

- This product is intended to be used with a general industrial product, but not designed or manufactured to be used in a machine or system that may cause personal death when it is failed.
- Install a safety equipments or apparatus in your application, when a serious accident or loss of property is expected due to the failure of this product.
- Consult us if the application of this product is under such special conditions and environments as nuclear energy control, aerospace, transportation, medical equipment, various safety equipments or equipments which require a lesser air contamination.
- We have been making the best effort to ensure the highest quality of the products, however, application of exceptionally larger external noise disturbance and static electricity, or failure in input power, wiring and components may result in unexpected action. It is highly recommended that you make a fail-safe design and secure the safety in the operative range.
- If the motor shaft is not electrically grounded, it may cause an electrolytic corrosion to the bearing, depending on the condition of the machine and its mounting environment, and may result in the bearing noise. Checking and verification by customer is required.
- Failure of this product depending on its content, may generate smoke of about one cigarette. Take this into consideration when the application of the machine is clean room related.
- Please be careful when using in an environment with high concentrations of sulphur or sulphuric gases, as sulphuration can lead to disconnection from the chip resistor or a poor contact connection.
- Take care to avoid inputting a supply voltage which significantly exceeds the rated range to the power supply of this product. Failure to heed this caution may result in damage to the internal parts, causing smoking and/or a fire and other trouble.

Electronic data of this manual

Electronic data of this manual can be downloaded at the following web site.

- Web Site of Motor Company, Matsushita Electric Industrial Co., Ltd.
<<http://panasonic.co.jp/motor/>>

Memorandum (Fill in the blanks for convenience in case of inquiry or repair)

Date of purchase	Date:	Model No.	(Driver) _____ (Motor) _____
Place of purchase			
	TEL:		

Motor Company
Matsushita Electric Industrial Co., Ltd.

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